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THE PRACTICAL TEACHER

PROFESSOR JAMES DEWAR, F.R.S.

CONTENTS
OF THE
OCTOBER NUMBER.

JEAN-JACQUES ROUSSEAU AND "ÉMILE." The Gleanings of a Pilgrimage. By J. H. Yoxall, M.P. ... 165
BY MANY HANDS ... 166
N.U.T. NOTES ... 167
NOTES FROM THE NORTH ... 169
FOREIGN NOTES ... 170
REPORT OF THE LONDON COUNTY COUNCIL ON THE APPLICATION OF SCIENCE TO INDUSTRY ... 172
GEOGRAPHY TEACHING IN GERMAN SCHOOLS ... 173
THE CASE FOR PHONETICS. By B. Dumville, B.A., L.C.P. ... 174
THE BRITISH ASSOCIATION AT BELFAST ... 177
EDUCATION IN THE UNITED STATES OF AMERICA. Special Reports on Educational Subjects ... 180
TEACHERS AND THE SUMMER EXTENSION MEETINGS ... 181
NATURE-KNOWLEDGE ... 183
THE INSPECTOR'S NOTEBOOK ... 185
A COURSE OF OBJECT LESSONS FOR GIRLS' SCHOOLS. By William Dore, B.A. ... 186
OUR MODEL INFANTS' SCHOOLS ... 188
NOTES AND JOTTINGS ... 191
OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE. By A. T. Flux ... 192
WEEKLY REVISION TESTS IN MATHEMATICS FOR SCHOLARSHIP AND MATRICULATION STUDENTS ... 197
GENERAL INFORMATION FOR SCHOLARSHIP ... 199
OUR CERTIFICATE COURSE FOR 1903. By O. Collar, B.Sc. ... 200
LOGIC FOR L.L.A. AND LONDON MATRICULATION. By T. E. Marshall, M.A. ... 203
CHEMISTRY ... 204
PHYSIOGRAPHY ... 205
THEORETICAL MECHANICS ... 206
OUR QUERY COLUMN ... 207
OUR FRENCH AND GERMAN PRIZE COMPETITION ... 211
THE EDITOR'S TABLE ... 212

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JEAN-JACQUES ROUSSEAU AND "ÉMILE."

THE GLEANINGS OF A PILGRIMAGE.

BY J. H. YOXALL, M.P.

I.

I TOUCHED the time-yellowed ivories of the tottering spinet; the keys were gapped and broken, like the teeth of an aged mouth. Yet at my touch sound floated forth, though but a thin, frail, far-away tinkle, the voice of a hundred and seventy years agone, a ghost of melody from the days when Rousseau touched the keys of that clavecin himself.

A score in the fine round hand of the young Jean-Jacques was before me,—

> "*Lucas, Lucas, ma maison brûle!*
> *O douleur sans seconde!*"

"Grief without aid, indeed," I thought, as I twanged out the notes of that old *chanson*. It was to the old-world *salon* wherein the spinet still stands that Jean-Jacques returned to find that his "place was taken," and the hillside home must be his no more. "I had quitted everything," he told; "I had renounced all, I departed, I flew, I arrived in all the transports of my first youth, and I fell at her feet. Ah, I should have been dead with joy had I found in her reception of me her caress, her heart, a quarter of the welcome she had had for me in the past. Terrible delusion of human things! Hardly had I been a half-hour with her before I felt that my ancient happiness there was for ever dead."

No hero, Rousseau; yet a great thinker, educationist, and writer, with an aureole of romance about his younger days. As I touched his clavecin I gazed from the windows of that little mansion on the hillside, and saw "the peak of Nivolet all crowned with stars" which Lamartine sings about: to-day it is topped with a cross. The stars of fame clustered around the head of Jean-Jacques in the after years, but all his life he bore the cross. Rusty, old-fashioned letters graven in mossed marble are overhung with wistaria and Virginian jasmine on the side of the house,—

> "*Réduit par Jean-Jacques habité,*
> *Tu me rappelles son génie,*
> *Sa solitude, sa fierté,*
> *Et son malheur, et son folie.*"

One's heart stirs sadly and yet generously as one stands on that wrinkle of the Alps at Les Charmettes.

A good plan for a foreign holiday is to wander in the footsteps of one of the great dead. I had done that along the track of Jeanne Darc; I was doing it now for a very different illustrious—Rousseau. To Annecy, where there are mountains, a lake, and islands exactly like a scene-painter's on an act-drop; from Annecy to Chambéry, and from Chambéry to Les Charmettes—that is the itinerary if you seek to track Jean-Jacques in the spots that saw his youth and formed his powers. It is a pilgrimage which touches a teacher and a writer to the quick. For Rousseau was the great innovator in the science of education, the prophet of "handwork," and the intellectual father of Pestalozzi and grandfather of Froebel. "It is not too much to say of Rousseau that he was the first who gave up thinking of the child as a being whose chief faculty was the faculty of remembering, and thought of him rather as a being who feels and reflects, acts and invents." Mr. John Morley says that *Emile ou de l'Education* is "one of the seminal books in the history of literature; it cleared away the accumulation of clogging prejudices and obscure inveterate usage which made education one of the dark formalistic arts, and it admitted floods of light and air into tightly-closed nurseries and schoolrooms." Rousseau's other great book, *Le Contrat Social*, was the seed of the Revolution. In his days at Chambéry and Les Charmettes this great writer and thinker was lover too, and one of the famous sentimental attachments of men who have made history lends charm to the memories which lie in wait for the pilgrim to that lovely corner of Savoy.

It is perhaps not so remarkable as it seems that Rousseau should have failed in the practice of education when he tried to be teacher himself. Yet he learned in the school of experience. Almost his first attempt at tuition was to be a teacher of music. At twenty years old his wanderings had brought him to Lausanne. He was penniless, and into his hot head, wherein any sudden fancy meant a prompt essay, came the idea that he should give himself out as a teacher of music. "Behold me, then, a singing-master who could not read a note!" is one of his "Confessions;" yet he had even the assurance to pretend himself a composer too. He vamped up a "symphony" for a concert that was pending. The orchestra assembled to rehearse the new piece; the scores were distributed; Rousseau was to conduct. "They

tuned up for five or six minutes, which seemed to me five or six centuries. At last they were ready. I rapped on my desk for silence; gravely I began to beat the measure; the orchestra began to play.....Never since French opera existed was there heard such a charivari of sounds. The audience opened their eyes, and would have been glad to close their ears."

A knowledge of musical notation must have been a rare accomplishment in 1732, for even this humbug of a tutor found pupils. "I learned music gradually while teaching it," he confesses, which is, perhaps, the original of the paradox that the best way to learn a thing is to teach it. Yet in the end he became a competent and even a famous musician. He invented a system of notation by numerals, lectured upon it before the French *Académie des Sciences*, and in three months taught his system perfectly to "une jeune Américaine appelée Mademoiselle des Roulins"—a Miss Rawlings, perhaps. In the beautiful Château de Chenonceaux I have seen the room he occupied and the splendid *salle* in which were performed the "plusieurs trio à chanter, pleins d'une assez forte harmonie," which he composed for the delectation of the other guests and their hostess, Madame Dupin. He was to enjoy other musical triumphs. Describing his pandemonium of a "symphony" at Lausanne and the reception of it and of its composer, he adds, "Poor Jean-Jacques! in that cruel moment you little hoped that one day before the king of France and all his court your musical compositions would excite murmurs of applause, and that in the boxes around you the most charming ladies would cry to each other, 'What delightful harmonies! what enchanting airs! how these songs go to one's heart!'"

It was much in the same way that Jean-Jacques came to understand the true science of education. As a teacher he failed; as a writer upon teaching he succeeded. At twenty-eight he left Les Charmettes to become the private tutor of the sons of M. de Mably at Lyons, the Provost-General of the Lyonnais. His stipend was to be about a guinea per month, with residence and table, and a bonus of three pounds or so if his services were appreciated. "I possessed much of the knowledge necessary for a preceptor," he wrote, "and believed myself to have a talent for teaching. By the time a year was out I had detected my mistake. The gentleness of my temper fitted me for the work, perhaps, but I had storms of anger at times. So long as things went well, and I could see the fruit of my toils and pains, I was an angel; but I was a devil when things went awry. I had two pupils of very different natures. One, eight or nine years old, called Sainte-Marie, was pretty, frank, quick, and merrily mischievous; the younger, called Condillac, seemed almost stupid, was as obstinate as a mule, and *could* not learn. Between the two I had my work cut out. With patience and *sang-froid* I might perhaps have succeeded, but for lack of one or the other I failed.....I perceived my own deficiencies as a teacher, and felt them acutely; I studied my pupils' characters, I penetrated their natures quite well, and I don't believe that I was ever once the dupe of their ruses. But what was the use of seeing the evil if I could not apply the remedy? At length, disgusted with an occupation for which I was unsuited, after a year's endeavour, during which I never spared myself pains, I determined to quit my pupils, quite convinced that I should never be able to educate them well."

Such was the early experience of the man who later on was to revolutionise the ideas and the practice of Europe in the matter of child-training by his famous *Emile*. Yet years of pain and struggle were to intervene. He hastened back to Les Charmettes, but his "place was taken" there. "*Lucas, Lucas, ma maison brûle! O douleur sans seconde!*" The house of his old happiness was burnt about him, so to speak. A supplanter had entered, and he must go forth, like Esau, into the world unknown.

I touched the time-yellowed ivories of his tottering old spinet, and evoked this ghost of melody from the years of long ago.

BY MANY HANDS.

"Quot homines, tot sententiæ."

Seeking Sanctuary.

ANENT the birching anecdotes recorded in our August number, it might have been stated that schoolboys of ancient and mediæval times enjoyed a privilege that is unknown to their modern prototypes. If legend and tradition may be trusted, the saints sometimes came to their succour. We are told that a boy, condemned to chastisement, once fled to the tomb of the good St. Adrian at Canterbury. The master was indiscreet enough to follow him there, and ignoring the boy's screams and protestations, proceeded to chastise him there and then. Twice the rod fell upon the victim's back, but at the third blow his right arm withered away, and it was not restored to its original state of health until the master had sought the lad's forgiveness. Then we find that St. Ermenilda always watched over the boys of Ely. One day a number of boys fled to her shrine for shelter; but the master, disregarding the claims of "sanctuary," dragged them forth and flogged them. Next day the offended saint appeared to him and completely paralysed his limbs; nor was their use restored to him until his pupils themselves had carried him to St. Ermenilda's shrine a repentant sinner!

* * *

The Whipping-Boys.

OF all the shamefaced frauds in the history of pedagogy, that of the "royal whipping-boy" assuredly takes precedence. When a prince of the royal blood disregarded his tutors, the birch was not applied to his royal skin, but to that of the "royal whipping-boy," who had been provided by the State for the purpose. Sir David Lindsay was the "whipping-boy" of James the Fourth of Scotland. Charles the First was provided with a "whipping-boy" in the person of William Murray, who was afterwards the father of the Countess of Dysart. An old play gives us a dialogue between a prince, supposed to be Edward the Sixth, and his "whipping-boy":—

"*Prince.* Why, how now, Browne, what is the matter?

Browne. Your grace loyters, and will not ply your booke, and your tutors have whipt me for it.

Prince. Alas, poor Ned! I am sorry for thee. I'll take the more pains, and intreat my tutors for thee."

It redounds to the credit of George the Third that he would have no "whipping-boy" for his children. Said he to their tutor, "If they deserve it, let them be flogged. Do as you used to do at Westminster."

* * *

The Art of Argument.

HE is an ingenuous youth—"The Public-School Boy" who sent a letter to *The Spectator* the other day suggesting that a short time should be devoted each week to the teaching of the "art of argument" to the boys of the high forms, to enable them more effectively to deal with the dogmatic utterances of their masters. But what a prospect the guileless proposal opens up! Imagine the lecture-room scenes that are likely to ensue when this "art of argument" idea shall have become operative—the droning professor startled in the middle of his humdrum by the interpolation of some callow Demosthenes, who, with a score of others perched around him, is watch-

BRITISH MUSEUM

ful and alert as a cock-sparrow waiting the advent of an unsuspecting worm. Then think of the sequel! Yet, mark you, there is to be no suspicion of "presumption or priggishness" on the part of these sprightly boys. To his lasting credit, our "Public-School Boy" hopes that this very training in the "art of argument" will enable them to do the thing in style, without the least suggestion of the prig. But what will the *pater* have to say—not to mention *mater* and the girls? In vacation it becomes a serious domestic question. We have heard of one "Eton stripling" who proved, by the "art of argument," to a simple-minded father that an "eel-pie" was a "pigeon;" and tradition says that the innocent father administered a salutary rebuke by proving in a similar way that a "horse-chestnut" was a "chestnut horse." But *paters* are not all alike. Many are not so ingenious, nor so patient. One can easily imagine how the peace of the domestic hearth might be disturbed if Adolphus should return from school a little too full of the "art of argument." "A Public-School Boy" will doubtless recognise these objections.

❧ ❧ ❧

YET many will sympathise with "A Public-School Boy." It is trying, often, to be obliged to listen to the utterances of some teachers, and to swallow statements without being allowed to reply. In the matter of sermons one frequently hears of grievances of the kind. The writer himself is mindful of a "cushion-thumper" who was particularly irritating in this respect. His style always awakened among his listeners a keen desire to rise and "have a go" at him with the "art of argument." But the law forbade, and, after meditation, one loyally acknowledged that the discipline of self-restraint is a healthy and civilising influence. But what about the "fag"? Would *he* not like to know something of the "art of argument"? The "young gentlemen" of the high form could hardly deny to this young product of public-school life the privilege which they would like for themselves. But, once granted, would it conduce to the harmony of life? One cannot deny that the world is largely composed of pairs of people between whom argument is impossible. The patient must not apply it to the doctor, nor can the contributor to his editor. The author must bide patiently under the lash of the reviewer. The poor little "fag" dare not resist the despotism of the "high-form boy," nor the child question the word of his mother. Like the pulpit and the papal chair, the master's desk will long continue secure from the assaults of "argumentation." And it is as well. Were the screws of society unloosened in these respects, it is obvious that the world would soon be thrown out of gear. So while we sympathise with "A Public-School Boy," we counsel patience and self-restraint for a little longer. He need not despair, and the exercise will fit him all the more for the suppressions he will have to endure in the greater public school—the world.

A Word of Sympathy.

❧ ❧ ❧

THE versatile "Dagonet" has been poking fun at Volapuk. He tells us that "the idea of making a universal language has taken a new turn. Figures are to be the common symbol for everything. For instance, *bread* will be *75*, and so on. Of the fluent new Volapukist we shall be able to exclaim, 'He lisped in *numbers*, and the *numbers* came.' That is to say, 'He said *75*, and they brought him bread.' But though the language may be easy to write, I don't quite see," says "Dagonet," "how it is going to simplify matters when you come to talking. If I say 'seventy-five' to a German, how is he to know that I mean 'fünf und siebzig'? And if a Frenchman says, 'Soixante-quinze, s'il vous plait,' how is any one to know that he wants 'pain à discretion'? The only universal language that has a real chance of coming out of the deluge of ideas, and settling on the dry land of practice, is the language of gesture and grimace—pantomime. Instead of bothering ourselves with a new language, which only one person in a million will ever learn, and that the person you are least likely to meet at the psychological moment, why should we not do the common sense thing, and return to the language in which human beings conveyed their needs to each other before there were any grammars and dictionaries in existence—the language of signs? If certain signs were agreed upon in addition to the pantomime which is common to all races, and these signs were taught in all the schools of the world, the difficulty would be got over."

An Improved Volapuk.

❧ ❧ ❧

THIS is all very pretty fooling, but the irrepressible jester suggests the practical solution. "For instance, suppose it is agreed that by putting your tongue out, you want a medical man; by crowing like a cock, you want an egg; by running one finger along the palm of your hand, you want writing materials; by going 'sh! sh! sh!' you want the railway station; by pointing with the first finger to your open mouth, you are hungry; with the thumb, you are thirsty; by drawing the first finger down the cheek, you want a barber; by holding your pocket handkerchief spread out in both hands, you want the address of a respectable laundress—there you are, and the thing is done. Look at the Southern Italian. A Neapolitan of the people will tell his neighbours a long story without uttering a word. Here, then, lies a *possible* universal language, and one that it is not beneath the dignity of science to recognise. And only think what a blessing such a language would be even among ourselves. Fancy the difference to our nerves and our comfort if the populace conversed in signs in the crowded thoroughfares. If pantomime were taught in all our schools, Board and Voluntary, and in all educational establishments abroad, we should be on the road to one of the most useful reforms that the world has seen for many a long day. An international meeting of pantomimists to settle the signs, and not only will the penalty of the tower of Babel be removed for ever, but the ceaseless shout and chatter that render the modern city a purgatory to all but the stone deaf will be abolished. London will cease to be a modern *Babble-on.*"

Practical Suggestions.

❧ N.U.T. NOTES. ❧

ANOMALIES abound throughout our professional existence; and perhaps none is more remarkable than the payment, by certain School Boards, of lower salaries to teachers in infants' schools than to those in "junior mixed" and girls' schools. Stranger still, it is usually only the *head* teachers who suffer from this differentiation, the class mistresses in the infants' schools being paid at the same rate as their certificated colleagues in "junior mixed" and girls' schools. From time to time the N.U.T. Executive has communicated with the erring School Boards, and achieved no little

Infants' Mistresses' Salaries.

success. London, however, is still obdurate, and I am glad to notice that its Head Teachers' Association is approaching the Board, once more, on the question. Two typical schools have been instanced to show the extent of the injustice:—1. School "A" (Junior mixed). Accommodation, 416; children taught, Standards I. and II., and in some years Standard III. 2. School "B" (Infants). Accommodation, 476; children taught, Standard I., and in some years Standard II., and infants of all ages from three years upwards. *Salary, £50 per annum less than head mistress of "junior mixed"!* I have heard the singularly lame excuse brought forward that, inasmuch as a paternal government pays, in its wisdom, a less capitation grant for the education of infants than for older scholars, the teachers in infants' schools must suffer a *pro tanto* reduction of salary. This is almost too absurd. The teachers of infants are apprenticed for the same number of years, receive the same instruction, and pass the same examinations as their more fortunate colleagues. They spend the same number of years in a training college, and here again pass the same examinations. They are required by the London School Board to have the same necessary certificates, *with kindergarten in addition.* The teachers say: "This kindergarten certificate is not easy to obtain. The system requires knowledge of a very varied character, as it embraces school management, botany, physiology, hygiene, a wide knowledge of natural history, and the ability to sketch rapidly on the blackboard." Mistresses who have had experience in both girls' and infants' schools claim that the work of an infants' school entails much the more physical strain and nervous exhaustion, "through the continued noise, activity, and change so concomitant to an infants' school." One can readily understand all this. Meanwhile, the dearth continues.

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The London Day Training College.

POSSIBLY no question engaging the attention of the House of Commons during the committee stage of the Education Bill has aroused so much *genuine* interest as the provision of training colleges. From *The London Technical Education Gazette*—the official circular of the Technical Education Board of the London County Council—one learns that the new Day Training College which has been established by the L.C.C. in connection with the University of London will be opened early in October. Temporary accommodation for the college will at first be provided in the new buildings of the London School of Economics and Political Science in Clare Market, near the Strand. The Technical Education Board has appointed a local committee to manage the affairs of the college, which will undertake the training of men and women intending to become teachers in primary schools, and also of those "who intend to become teachers in secondary schools." (Thus we see that even so democratic a body as the L.C.C. seems unable to get rid of the hateful Columns "A" and "B" idea.) The students training for the work of the primary schools will be expected to go through a three-years' course, so as to enable them to take their degrees on leaving the college. With this object in view, students will be required to have passed the Matriculation Examination of the London University before being admitted to the college. The arrangements with regard to students who intend to become secondary teachers do not seem to be yet definitely fixed; for the present (says the prospectus) "it has been decided that the course of these students will be entirely post-graduate, and no student will be admitted who has not obtained a degree or passed an examination qualifying for a degree." The fees for the professional course at the training college, for both primary and secondary students, will be £10 a year, "which, in the case of the Board's training scholars, will be covered by the payment made directly to the college on their account by the Board of Education." The Principal of the College is Professor Adams, M.A., B.Sc. (Professor of Education in the University of London); the Normal Master is Mr. D. R. Harris, B.A. (Assistant Master of Method and Lecturer on Education in the University College of Wales, Aberystwyth); and the Normal Mistress, Miss Margaret Punnett, B.A. (Principal of the Cambridge Day Training College). *Floreat!*

* * *

With the Belgian Teachers.

TEACHERS' conferences in other lands are usually held during the summer vacation, and during the month of August English deputations have journeyed to Holland, Belgium, and France, with the double object of conveying fraternal felicitations, and gathering information concerning the educational systems of our foreign neighbours. The vice-president of the Union, and the genial veteran, Mr. G. J. Rankilor (in place of Mr. Blacker, who was detained in England owing to the sad death of his father), visited Holland; Messrs. Harris and E. R. Phillips went to France; and our worthy treasurer was my *compagnon de voyage* into Belgium. The *venue* was at Namur, and to that picturesquely-situated gate of the Ardennes we wended our way, *via* Harwich, the magnificent new S.S. *Brussels*, Antwerp, and "Little Paris." We reached Namur on the eve of the Congress, taking up our abode at the homely and eminently comfortable Hotel d'Harscamp. After a rest and quiet meal, we sallied forth to the Café de l'Univers, in the Place d'Armes, where what the *Journal des Instituteurs* termed a *réunion intime* was taking place. We met some old friends (amongst these, the ubiquitous and jovial Van Dam), and made many new ones, including M. Pâquet and M. Pétry, the vice-president and secretary of the local conference committee, who throughout the week showed us many kindnesses.

* * *

The Opening Day.

SUNDAY is emphatically the "big day" of the Belgian Congress. At 10.30 a.m. the delegates assembled outside the fine railway station, and, preceded by a brass band, went in procession and *en grande tenue* to the Hotel de Ville. There we received a characteristic and hearty welcome from the communal authorities, and the champagne glasses being duly charged, the *vin d'honneur* disappeared to the toast of "Success to the Congress." M. Van den Dungen, the old man eloquent of the Federation, having responded, the procession was re-formed, once more the band struck up, and we hied to the Kursaal, where the *séance d'ouverture* was held. The local president extended to us a second welcome, M. Van den Dungen delivered a particularly brief presidential address, and then came the turn of the "foreign delegates." Possibly encouraged by my friendly reception last year at Mons, I again essayed to speak in French, and some little interest may attach to the following sentences:—

Next Month:

AN ART SUPPLEMENT

will be presented.

The N.U.T. President's Speech.

MONSIEUR LE PRESIDENT, MESDAMES, MESSIEURS, —Pour la seconde fois, c'est mon privilège d'assister au congrès annuel des membres de la Fédération Générale des Instituteurs Belges. L'année dernière, je fus l'objet d'une bienveillance et d'une hospitalité si grande de la part de vous tous à Mons, que je fus charmé d'être chargé une fois de plus (avec mon bon ami Monsieur Hamilton, notre estimé trésorier honoraire) de vous transmettre les salutations fraternelles et les souhaits les plus cordiaux de plus de quarante-cinq mille membres de l'Union Nationale des Instituteurs Anglais.

"Nous reconnaissons pleinement que jusqu'à un certain point, le but et les aspirations des instituteurs belges sont identiques à ceux de leurs frères anglais. Nous souhaitons une prosperité continue à votre grande Fédération, et espérons vivement que vos delibérations de cette semaine soient couronnées de succès.

"Si je comprends bien, vous voulez (comme l'année dernière à Mons) consacrer beaucoup de temps à la rédaction de ce que nous appelons en Angleterre, un 'Education Bill.' Ce qui semble assez singulier, à la récente conférence de l'Union Nationale des Instituteurs Anglais, nous aussi, nous discutions un 'Education Bill' qui venait d'être introduit au Parlement par le Gouvernement Anglais. Nous demandions au Gouvernement de faire spécialement une chose. C'était d'accorder plus d'argent aux écoles pour que nous puissions mener à bien le grand problème de l'Education. Il vous interessera peut-être d'apprendre que nous avons obtenu une somme additionelle, annuelle, de deux millions et demi de francs pour les écoles. J'espère, de tout mon cœur, que vous puissiez arriver à un succès également grand.

"Me pardonnerez-vous si je m'aventure à répeter une phrase de ma courte adresse faite l'année dernière à Mons: 'Notre ardente espérance est que ces visites mutuelles puissent faire quelque chose pour créer parmi les peuples du monde entier un esprit d'amitié et de réele fraternité. Nous faisons tous nos efforts pour que ces visites puissent regénérer la théorie de la relation du sang, dans le fait, et dans la réalité de sentiments mutuels et d'amitié durable.'

"Pendant plusieurs années, nous avons eu le plaisir, à nos conférences annuelles de souhaiter la bienvenue aux membres de votre Comité Général. De tout temps ils ont été des plus cordialement reçus; car nous reconnaissons que la profession d'instituteur n'est non seulement pas nationale mais aussi internationale. J'espère que deux ou trois de vos membres pourront venir, à Pâques prochain, à Buxton, qui est une charmante ville du centre de l'Angleterre. Je puis vous assurer que nous ferons tout ce qui est possible pour rendre leur séjour agréable, instructif, et des plus confortable."

Business Done.

THE four "business" sessions of Conference were devoted almost entirely to the consideration of *un projet de loi*, or kind of "Education Bill," which had been already fully discussed the previous year. In the forenoons of both the second and third days the French and Flemish sections met separately, under their own chairmen; whilst in the afternoons they came together under the president of the organisation, who, of necessity, must be well acquainted with the language of each section. Where the sections had come to a similar decision on any point, all discussion was waived; but when they differed—and this was fairly frequently—they threshed the matter out in full assembly. I have no space to record the decisions arrived at; and after all, they are of no great consequence. Our charming guest at York and Yarmouth, M. Rossignol, made a lengthy and closely-followed statement regarding "La Caisse des Veuves et des Orphelins," and I was glad to see the unanimity with which this interesting and practical subject was referred to the local associations for their consideration.

Festivities.

AFTER the last business meeting was held the Fête des Présidents, whereat M. Van den Dungen, the thirty-one years' president of the organisation, was presented with a marble bust of himself, executed by the Brussels sculptor M. Bastin; and the presidents of the French and Flemish sections were each the recipient of a handsome bronze. The ceremony was touching in the extreme, for two years ago the Congress decided that no future officer should have a longer tenure than two years. Emotion and eloquence were naturally mingled in the farewell words of the three estimable gentlemen. The banquet was the vivacious, bustling success it ever is; whilst the excursion to the world-famed grotto of Han, the following day, was a triumph of clever forethought and careful arrangement. My genial colleague made a happy little speech at the banquet, and "God Save the King" was sung with the utmost heartiness and *verve*. A. C.

NOTES FROM THE NORTH.

Physical Training.

THE Royal Commission on Physical Training held some twenty sittings during the months of April, May, and June, and the minutes kept have been issued in a bulky volume of 850 pages. The inquiries have regard to the provision of physical training in elementary schools for pupils under fourteen, and in continuation schools for older boys and girls between fourteen and eighteen. The points the commissioners sought to elucidate were: What is the amount of drill which ought to be given in the school? What time should be given to it? Is it desirable to have anything like a uniform system of drill, or is it desirable to allow considerable freedom of choice as to the form of drill that is to be adopted? There seems to be a pretty general agreement among the witnesses examined that there should be more physical training than at present. Many, however, deprecate military drill; some prefer physical exercises; others would rather have a judicious blending. Again, it appears that the majority are agreed that this training should be systematic and compulsory. The idea present in some minds is that military drill is valuable as a means of discipline; but others see in physical exercises the power of developing the muscles and expanding the chest and lungs. The lack of sufficient space would operate against military drill. It would not be possible in town schools to obtain parade grounds. Some suggested that three or more schools might be combined in some large park acquired by these School Boards. Probably the result of the commission will be to establish a compromise. The difficulties are great.

Teachers and the Subject.

ONE very important point in connection with this subject is the amount of time to be given to the subject. The overburdened curriculum already looms large in the eyes of teachers. Of course, it may be urged that some subjects might be jettisoned to make room for this new one. Again, the training of teachers is a

matter that would require careful consideration; it would have to be done under proper supervision. Will teachers require to go for six weeks to camp? Already, with regard to the introduction of nature study and free-arm drawing, teachers in Scotland are spending their Saturdays in acquiring knowledge in these. Will they now require to equip themselves in military drill? It was suggested that the drill might be taken on Saturdays. This, I am convinced, would meet with considerable opposition from parents. The question of organising school games after the method of Germany came in for some discussion. By some witnesses it was strongly recommended, by others it was objected to on the ground that games when organised do not give pleasure. The Commission, when it reassembles on September 15, will hear more evidence, and, no doubt, will allow reporters, as thereby a greater interest will be evinced in the subject by the general public. The Commission is bound in many ways to do much good. The happy medium, however, will require to be struck with regard to the conclusions drawn from the evidence, or the whole matter will prove a fiasco.

BY the sudden death of Mr. J. Maxton at Millport, the teaching profession and the Educational Institute of Scotland have lost a distinguished member. Mr. Maxton was for many years a member of the General Committee of the Institute, in which capacity he did sterling work. As secretary of the Renfrewshire Branch for many years, he did much to foster interest in and increase the membership of the Institute. Mr. Maxton for many years sought to advance secondary education, and his school at Barrhead was one of the most successful in the county. He was a good speaker, and was always listened to with great respect in the councils of his fellow-workers. He was quiet and unassuming, and perhaps few of us in the General Committee knew the work he had done on behalf of the Institute. His place will be difficult to fill.

The late Mr. Jas. Maxton, Barrhead.

SIR HENRY CRAIK in his report on Secondary Education for 1902, in referring to the subject of a business education for a business career, says:—"For some time past there has been growing dissatisfaction in Scotland regarding the defective education of youths entering upon a mercantile career. That dissatisfaction is a thoroughly healthy sign. It means that commercial men are more and more realising the supreme importance of a sound mental training. The remedy for the present state of affairs lies in their own hands. The educational machinery of the country can never have a fair chance until merchants in a body set their faces against the practice of putting boys into business at thirteen or fourteen, and until, in their selection of apprentices, they give preference and reasonable encouragement to those who produce evidence of having profited by their school training. It is to this rather than to the institution of fresh examinations that the country must look if it desires that lads should enter business properly equipped for the work of life. Examining may become a serious danger if there is too much of it. Already some of our inspectors report that schools are suffering, not only through the strain of having to adapt themselves to too large a variety of outside requirements, but even through the actual loss of time that the mere writing of papers entails upon the pupils. This is a matter which demands the most careful attention alike on grounds of health and of educational policy."

Business Education.

THE Scottish Class Teachers' Association, in view of the increased remuneration being offered by various School Boards to class teachers, and on account of the great dearth of teachers, have prepared a new model scale of salaries as follows—

Model Scale of Salaries.

Population served by School Board.	Masters.				
	Class.			Departmental.	
	Class Masters.		Class Masters in Secondary Dep'tments.	Masters in charge of Departments.	Second Masters.
	Minimum.	Maximum.	Maximum.	Maximum.	Maximum.
60,000 and over	£100	£160	£250	£200	£260
15,000–60,000	100	150	220	180	240
Under 15,000	100	140	200	160	220
Increments...	£5 annually		£10 annually		

Population served by School Board.	Mistresses.			
	Class.			Departmental.
	Class Mistresses.		Class Mistresses in Secondary Departments.	Infants' and Departmental Mistresses.
	Minimum.	Maximum.	Maximum.	Maximum.
60,000 and over.	£70	£130	£150	£175
15,000–60,000....	70	120	140	160
Under 15,000....	70	100	120	150
Increments.....	£5 annually		£10 annually	

This model scale has been sent to all the School Boards of Scotland, together with extracts showing the evil results of staff-changes, etc. The membership of the Association now stands at 4,093.

CONSEQUENT on the retirement of Mr. A. Walker, Chief Inspector in the northern division of Scotland, several changes in the Inspectorate have taken place. Mr. F. R. Jamieson, Dumfries, is transferred to the district comprising Argyll, Renfrew, and part of Glasgow; while the Dumfries district is taken over by Dr. A. Douglas Thomson, Edinburgh. Dr. Thomson's work is to be taken over by Mr. Miller; while the vacancy caused in the Inspectorate has been filled up by the appointment of Mr. James Clark, M.A. (Aberdeen University) and B.A. (Oxford), Rector of Dumfries Academy.

R. G.

Changes in the Inspectorate.

FOREIGN NOTES.

OUR Dutch contemporary *Het Schoolblad* contains interesting articles on the ever-recurring question of modern language teaching. The introduction of the direct method is said to have had a stimulating effect everywhere, the results obtained being undoubtedly better than those of the old method. The pupils are more eager, and their vocabulary and power of expression much greater; but the difficulty is that many of the teachers are themselves lacking in "Vaardigheid," and this lack of ease and fluency tends to drive them back to the old ways of translation, silly exercises, and word-hunting. The writer tells the tale of one teacher who attempted a

"Vaardigheid."

conversation with a Frenchman, with the pitiable result that after long and painful stuttering, the only words that forced their way out were, "Il va pluir!" (pleuvoir).

IF this is so among the Dutch, who are renowned as good linguists, we may be sure that the same difficulty will be sooner or later felt in England. The only remedy will be to send selected teachers for prolonged residence abroad; and whatever public money is spent thus will be well spent. The number of teachers who are enthusiastic enough to devote their holidays to language work year after year will never be very large, so that if modern language teaching is to succeed in England, a regular system of preparation by thorough study on the Continent will be necessary. It is hopeless to expect results from foreign teachers; the well-equipped English teacher is what we need.

The Remedy.

WE who were children long before child study was invented ought to be thankful, for we were never bored with mysterious questions, nor made the subject of strange experiments. The *Journal des Instituteurs* tells us that somebody has been setting the following questions to his pupils of six to eight years of age:—1. Who is afraid of the dark? 2. Of what are you afraid? We forbear to give the inevitable statistics which follow, because any one who understands child nature is quite aware that the figures determine no scientific truth, for the simple reason that children's answers under these circumstances are not trustworthy data. Why do not these old fogeys compare notes upon their own childhood? or are they too old to remember how they felt in the dark?

More Child Study.

LE Roman d'un Enfant, a charming book for teachers to read, seems to prove that Pierre Loti, at any rate, has not forgotten what childish fears and imaginings are like. His description of a baby's first delightful dance in the dancing firelight is worth a ton of pedantic child study. It seems little short of ludicrous to compile figures upon the question of the child's fear of the dark. Any adult who can remember the weird monsters he saw in his childhood requires neither figures nor explanation, although the *fact* is interesting as showing the power of the subjective over children. I have noted cases where intelligent imaginative children have felt fear or horror of certain pictures, so that they would slam the book wildly in order to shut out the fearsome sight.

Pierre Loti.

SOME experiments may certainly be made with useful results. We recommend teachers in elementary schools, particularly in rural districts, to read to children a short newspaper article upon some great national subject which they ought to understand, and then ask them to write down what they have grasped. Or tell them an interesting story, and suddenly end it with polysyllables like the following, "He dismissed him over the vessel's side with no very complimentary application to accelerate his exit." The results, which he may put in figures if he is fond of that kind of thing, will lead him to wonder how it comes that we allow the English language to remain a foreign language to our pupils.

Practical Experiments.

THE French elementary teachers have been grossly insulted by one of their députés, and are in a state of towering indignation, if we may judge by the pages of the *Manuel Général*. This is the vulgar abuse which has roused them: "The elementary teachers are a devouring plague in our country, a plague which will be its ruin if we are not careful. There exists in every commune of France a man half-bourgeois, half-peasant, and yet detesting both these classes. He is eaten up with pride, hatred, and jealousy; he rules the parish, lords it over the mairie, domineers the school, annoys the curé, and oppresses all with his peevish pedant tyranny."

Insults and Protests.

"HE is the master, or at least he wants to be. Woe to the maire who should try to burst the bonds of his tiresome tutelage! The poor maire would soon find himself out of office. The schoolmaster is the important indispensable man whose finger is in every pie. He keeps on the right side of the sub-prefect, he makes the gendarmes to tremble. He defies the chief inspector, does not accept unreservedly even the authority of the prefect, and holds the municipal council in leading strings. Since some fool or other proclaimed that we were beaten in 1870 by the German schoolmaster, ours has become an undisputed potentate, the pasha of our country districts; and, of course, he is on the side of the Government."

More Abuse.

THERE is much more of this shrieking diatribe, and its violence reminds me forcibly of an attack made some time ago upon English elementary teachers, and which was met, if I remember rightly, by dignified silence. Having noted it at the time as a suggestive phenomenon, I reproduce it here for the amusement of our readers: "The elementary teacher is something less than a mediocrity; he is not at all a gentleman, but a half-educated, narrow-minded, small middle-class man, unintellectual, knowing hardly anything well, parochial in sympathies, vulgar in his accent and style of talking, with a low standard of manners and a machine-made mind. Except for these trifling defects, of which he is not and cannot be conscious, he is an excellent fellow." What an amazing conceit of himself this man must have had to rise to the temerity of writing such a criticism of English teachers!

An English Parallel.

COMPARING these two attacks and the manner in which they were received, I cannot help turning to M. Emile Boutmy's study of our national character, and his praise of the Englishman's impassible endurance when under fire. He contrasts this with the agitation, the quick movement, the mad forward rush, which are necessities to the Frenchman when attacked. M. Boutmy naturally attributes the French characteristic to the more alert wit and finer sensibilities of his countrymen; but to us this sensitiveness appears at best an amiable weakness, while the stoic strength that can bide its time, and then strike hard, is a quality we all admire.

Racial Character.

IF we might presume to follow La Rochefoucauld, and probe the depths of human motive, we should describe the virulent language of the French député and the supercilious sneers of the superior person as the promptings of the ugly monster Caste, who prevents the man of one class from

Caste.

seeing what is good in a fellow-creature of another, who whispers to one educated man that he of a lower class is "only half-educated, and something less than a mediocrity," who widens the clefts between class and class until they are yawning chasms that make the thinker shudder. But let us turn from this unpleasant subject to the thoughtful pages our German brethren send us, and consider how they would bind all classes of their nation into fraternity and unity and strength.

A GREAT thought has been seething for years in the minds of German educationists, and the twentieth century may perhaps see the thought realised in action.

Die Einheitsschule. By the *Einheitsschule* is meant a unified organisation of the whole educational system, such that *all* children of the nation shall receive up to their twelfth year one common training. Beyond this age they differentiate into various kinds of schools, ranging from the continuation to the classical school. Entrance to the higher grades would not be determined by the fortune or social position of the parents, but by the talents and diligence of the child. Gifted children of the poorer classes would be promoted at the cost of and for the benefit of the state. There would be no artificial barriers severing child from child or teacher from teacher.

IT is Paul Bourget, I think, who has written wise words on "les déformations professionnelles," the peculiar warping caused by specialised professional education, so that, for instance, a medical man in his zeal for science might grow callous to the ordinary claims of humanity, or a barrister, proud of his forensic skill, might be deaf to the voice of justice. Pursuing this thought further, we perceive how a caste-cribbed system of education may range the poor in hostility against the rich, the hand-workers against the brain-workers, labour against capital. And it is to prevent this perilous cleavage of the social fabric that German thinkers advocate the fraternal training in common of *all* children of the state. Professional work tending to narrowness and social estrangement, the fundamental general education should tend to social unity.

Professional Deformation.

BY this system no clever brains would be lost to the nation. They would find, naturally and simply, their proper work; they would develop freely, not, as now so often happens, stunted, gnarled, and warped, like oaklets beneath crushing boulders. The common training of all the citizens would create national and social unity, and the clefts out of which creep discontent, revolution, and anarchy would be closed. Sympathy, mutual understanding, would grow up between class and class; for both high and low would remember the days when they were brothers and equals on the benches of the *Einheitsschule*. It is a beautiful idea, but too good for this wicked world.

National Strength.

WE have been showing how the poor pedagogue is insulted and abused at times. But there are happy realms where he is exalted, put upon a pedestal, reverenced. English readers will think I am joking, but I am quite serious. A writer in the *Schweizerische Lehrerzeitung* gives much grave advice to young teachers, warning them that they must not grow conceited in the atmosphere of adulation in which their lives will be spent, and in which their every word will be respectfully repeated as an oracular utterance: "the Herr Lehrer said this, the Herr Lehrer said that." The young teacher is urged to direct his gaze upwards, so that he may be something better than a Triton among minnows. This is all very comical to English people, but instructive too.

A Triton among Minnows.

A. E. S.

REPORT OF THE LONDON COUNTY COUNCIL ON THE APPLICATION OF SCIENCE TO INDUSTRY.

THE Technical Education Board of the London County Council has always shown a laudable desire to expend its share of the "whisky money" strictly for the improvement of technical education. The Board speedily realised the fact that, even where science was taught at all, it was of far too academic a character, and the issue of its report in 1896 on the teaching of chemistry has had a very beneficial influence on the teaching in our secondary schools. During the present year the Board has set itself to investigate the truth of the statement that is frequently made that England is being left behind in the great commercial struggle, and, should this prove to be true, to ascertain how far it is due to the inferiority of the scientific training obtainable in this country.

A very able sub-committee was appointed, and opinions and testimony were obtained from experienced employers in various branches of industry, from distinguished investigators, and from some of the leading professors and teachers of science.

The report which has just been issued should prove of immense value to educationists and to all those who have the true interest of their country at heart.

Referring to the loss of business, the report says: "We are unable to resist the conclusion that various branches of industry have, during the past twenty or thirty years, been lost to this country owing to the competition of foreign countries, and that in many others our manufactures have fallen seriously behind their foreign rivals. We may refer, as the leading case, to the transfer from England to Germany of numerous departments of manufacturing chemistry."

The report then discusses very fully some of these departments, such as the manufacture of aniline dyes, fine glass, electrical plant, and scientific instruments.

The original investigations and discoveries on which the manufacture of aniline dyes is based were made almost entirely in England, and the manufacture itself was largely carried on near London, which, owing to its gas-works, is the largest producer of raw material. From 1858 to 1872 the United Kingdom made more coal-tar colours than any other country; but the business has now practically passed out of our hands, not a thousand workmen being employed in it in this country, and we now pay over three millions sterling for imported chemical dye-stuffs of one kind or another. The loss of this vast and growing industry is of serious import to us. We learn that "the new colouring matters, made almost exclusively in Germany, have in many cases been introduced as substitutes for natural products, which were staple articles of English commerce. Madder and cochineal have been replaced by alizarin and azo-scarlets, the employment of many dyewoods has greatly decreased, whilst at the present moment logwood and indigo are seriously threatened. The complete capture of the indigo market by the synthetic product, which would mean a loss to our Indian dependencies of £3,000,000 a year, is regarded by the Badische Company as so absolutely certain that, having already invested nearly £1,000,000 in the enterprise, they are at present issuing £750,000 of new debenture capital to provide funds to extend their plant for this purpose."

We turn to another typically English industry — the production of fine glass for scientific and optical purposes. A generation ago the bulk of this manufacture was in English hands; but German chemists have succeeded in

introducing such modifications in the manufacture of optical glass that German opticians have been enabled to place on the market lenses approaching more closely to mathematical perfection than any previously manufactured in this country. It is interesting to find the following in the price list of the Jena Glass Works: "Sincere thanks are offered to the Prussian Bureau of Education and to the Diet of the Kingdom for the very liberal and repeated subsidies by which costly experiments on a manufacturing scale had been rendered possible." It is also worthy of notice that the experiments carried out in connection with optical glass have created in Germany several subsidiary industries, such as the manufacture of thermometers for accurate physical measurements, the manufacture of X-ray tubes, the manufacture of lamp chimneys, etc. With regard to electrical machinery, Professor Ayrton says that English buyers give their orders to other countries, not merely because of the lower price, but because they get distinctly better goods than any that can be obtained in this country irrespective of price, the reason being that the English manufacturer has too little idea of the value and importance of minute attention to scientific details. Another industry that is in danger at the present time is pottery, especially of the finer kinds. Dr. Thorpe points out that the English manufacturer is generally entirely ignorant of chemistry, and does not appreciate the importance of employing chemists, whereas American manufacturers take great interest in chemistry, and are rapidly overtaking us in the manufacture of ceramics.

Having shown that there is a serious loss of trade, the report sums up the evidence as to the causes of this loss as follows:—

1. The lack of scientific training of the manufacturers themselves, and their consequent inability to recognise the importance of scientific assistance. "The English manufacturer," says Mr. A. G. Green, "has considered that a knowledge of the benzole market was of greater importance than a knowledge of the benzole theory." The result is that he has presently found the market lost to him, without his knowing why.

2. The defective condition of our secondary education, and the consequent lack of sufficiently prepared recruits for advanced technological training.

3. The lack of a sufficient supply of young men who have been trained, not only in scientific principles and method, but also in the application of science to particular industrial processes.

4. The lack of any institution providing advanced technological training which is sufficiently equipped and endowed to enable it to give adequate attention to post-graduate or advanced work.

On this last point Sir Henry Roscoe voices a general opinion in declaring that "the most important requirement here in order to provide the necessary training for leaders of industry is a perfectly equipped school for theoretical and applied science, similar to those of Charlottenburg, Zurich, and Munich, with several professors in each faculty. There is no institute of this kind in the country."

The following outline of the education of a leader of a scientific industry is given by Mr. Swan, the eminent electrical engineer:—

1. A good general education on the classical or modern side of a secondary school up to the age of seventeen or eighteen, special attention being given to mathematics and elementary physics, the latter being taught in such a way as to educate the mind and fingers of the student to work accurately.

2. Three years' training for the B.Sc. degree, followed by

3. Two years' "post-graduate" work in order to obtain the D.Sc.

In conclusion, the committee regrets that it is unable to make any definite suggestions to the Council, as the sum of money required to put London in a position to equip itself as well as, say Berlin, is altogether beyond the amount which it can legally spend on technical education. The matter is one of national importance, and concerns, not London alone, but the country at large; it is, therefore, the duty of every one to urge upon the Government the necessity of dealing with the whole question in a bold and liberal spirit.

GEOGRAPHY TEACHING IN GERMAN SCHOOLS.

THE scientific teaching of geography is year by year receiving more and more attention, both from the educational theorist and from the earnest practical teacher. That being so, it occurred to me to give a few notes of what I have had the opportunity of observing of the treatment of this subject in German schools. Some of the methods and probably all the principles I shall discuss will be known to any up-to-date teacher; yet something may be interesting even to the experienced pedagogue, seen as it is through the spectacles of one who knows a little at least about the difficulties which English teachers have to contend with in the teaching of this difficult but fascinating subject.

The German teacher seeks his starting-point in the experience of the child—a fairly well-known principle to us, too; but it differs in its applications. The German, when he has a principle of education, is very thorough-going in applying it; so, in this case, *all* his teaching is based upon the experience of the child. In the "Heimatskunde" lesson he seeks to give clearness and definition to what the child has often seen but never really looked at; to direct its attention to what it may only accidentally have seen,—to endue the thing with vividness in colour and form. This being so, during the first years of school life much time is given to the examination and discussion of the common and ordinary surroundings, the school itself, the streets of the town or village in which the child lives, and the immediate neighbourhood. The results are obtained by personal observation—no second-hand information is admitted as knowledge. Walks are made in the neighbourhood in the company of the teachers during ordinary school hours, and the children are made first to examine and then to talk about what they have seen. There is no stage of mere definitions in a German school; definitions are all arrived at inductively. It is not till the child gets back to the school that the definition is discussed. During the walks, all the scholar has to do is to give a clear and connected account of what he has seen, and this without the stimulus of constant questioning to spur him on. Let me give an account of the way in which the meanings of the terms river, spring, source, bed, etc., were taught—a way charming in its very simplicity.

The class consisted of about twenty children of from seven to eight years old. They were taken into the park in Weimar, through which runs a little river. First of all, they were taken to a rustic bridge and made to look at the river. They were asked which way it ran, but the current was so slow as to give rise to differences of opinion. To settle the matter, therefore, the teacher took a handful of twigs and leaves and threw them into the water; then it was evident enough. Next came the distinguishing between the right bank and the left; and in order to add all possible certainty to the knowledge gained, the class were set to stand in different positions to pick out the right and left banks. Then they were led off the bridge to the bank of the stream, where they could see the shelving of the banks and the bed of the river; but before the lesson was finished, a clear and connected statement of the facts, and the way in which they had been arrived at, was made by the scholars themselves, and being well used to that sort of thing, the cogency of the statement and the arrangement of the matter were very remarkable.

Next day came another geography lesson, this time in the classroom, and the time was spent in recapitulating the account of what had been seen, and in reducing it to a blackboard summary. The children were made to pick out the important words of the account to serve as catch-words, by means of which the sentence could be recalled; and lastly, the summary was written in a note-book for future reference. No dull repetition of meaningless definitions, but the acquirement of living, vivid, personally-observed facts, was the order of the day; and

the eagerness and vivacity of the children were the justification of the course pursued.

While keeping the immediate object of the expedition in view, the teacher does not confine the class to those facts the observation of which is his immediate aim. The scholars are encouraged to ask questions about the animals and plants seen during their walks; and these digressions, besides being valuable in the collection of material for the object teaching, are stimulating in their effects upon the attention of the children. The only digression prohibited is the irrelevant, and on that account the lesson never degenerates into mere empty chatter.

Another very important point to which much attention is given is the measurement of distances and areas with the eye. The dictum of Rousseau that "measurements shall be made not only with the hand but also with the eye" is obeyed to the letter. When the class is out upon an expedition or a walk, the children are called upon to estimate the distances between different objects. Short distances are taken first, and these are made to form the standard, by reference to which longer distances are estimated. Longer and longer distances are taken as proficiency increases; and in order that there may be no element of guesswork in these exercises, the results obtained are verified or corrected by "pacing" afterwards. This is very valuable, especially in a country where military proficiency counts for so much; but the value of the training of the sight as a purely educational object is far more valuable.

The recapitulation in class of what has been seen is a very useful exercise of what the psychologists call the "reconstructive imagination." The desks and other school furniture are made to represent different features of a landscape, or the ground-plan of a part of a town, and the children themselves are supposed to place them in their proper relative positions, according to the cardinal points.

This, of course, is a preliminary to the process of plan-making, which is later proceeded with. The first plans are drawn in sand or gravel with a stick, a place in the school playground being set aside for this purpose, and it is not till proficiency in this has been attained that a plan proper on the blackboard is prepared. Even yet, however, the blackboard is kept in a horizontal position, and the cardinal points marked upon it. After this, it is raised to its normal position, and the class realises why the north is at the top of the plan, the south at the bottom, and so on. From the plan to the map is a very little distance, and the real meaning of a map is very thoroughly understood, because the way has been made so smooth that the ordinary misconceptions are not allowed to arise.

Thus far the teaching has all been designed to prepare the way for the teaching of what we call political geography by providing the child with clear impressions of what lies within its own circle of observation, these impressions serving as a measure by which he may judge the unknown in its relation to his known. When this geography teaching is started, in order that the links may be kept inviolable, the home country, or rather the home state just outside the child's ken, is treated first, and an ever-widening series of circles round his own home district is described. Thus he never really loses sight of what lies within his actual experience, and, as a result, the teaching never becomes nebulous and vague.

During the whole course of school life a series of exercises is set, depending, of course, upon the seasons, climatic conditions, etc., in the observation of certain natural phenomena which cannot be seen during school hours. The children make their observations, and are expected, at a time set apart for the purpose, to give their accounts of what they have seen, the teacher's work being to compare evidence, clear away irrelevancies, and to correct vague impressions. Exactness of language is insisted upon, as well as exactness of observation; and the interest aroused in this independent work testifies to its value as a means of promoting individual effort. I subjoin a short and fairly typical list from which the nature of these observation exercises may be gathered:—

1. *Shadow Measurements*—
   (*a*) The movements of shadows.
   (*b*) Their positions at midday; at hours of the day at the same distance from midday; at the same hours on different days in the year.
   (*c*) The length of shadows; alteration in length during the day; same lengths in forenoon and afternoon; alteration of the length of shadows at midday of various days in the year.
2. *The Sun*—
   (*a*) Rising and setting; time and place of the same; glow at sunrise and sunset; positions of sun during the day.
   (*b*) An eclipse; time, form, position of sun, earth, and moon; appearance of the moon.
3. *Temperature*—Alterations during the day, and at different times of year.
4. *Winds*—Strength and direction.
5. *Appearance of the Skies*—
   (*a*) Number of clouds.
   (*b*) Movements of clouds.
   (*c*) Cloud forms.
6. *Rain, Snow, Hail, Mist, Dew, and Hoar-frost*—Times of the year when most frequently occurring.
7. *The Rainbow*—Conditions under which it appears; position in relation to the sun; colours.
8. *A Storm*—Signs of an approaching storm; time between thunder and lightning; nature of downfall.
9. *The Moon*—
   (*a*) Rise and fall; place and time.
   (*b*) Movement.
   (*c*) Alteration in form.
   (*d*) Position in relation to sun when waxing and waning; at new and full moon.
   (*e*) Time between two full moons and two new moons.
   (*f*) Eclipse of the moon; time, form, position of sun, earth, and moon.
   (*g*) Appearance.
10. *The Stars*—
   (*a*) Constellations—Great Bear, Orion, etc.
   (*b*) Stars of the first magnitude in certain constellations.
   (*c*) Stars that do not set; stars that do set.
   (*d*) Planets—Venus as morning and evening star; Jupiter.
   (*e*) Shooting stars.

The ordinary oral geography lesson in the higher classes differs very little from such a lesson as given in England. The great feature of the teaching is the care with which the preparatory stages are worked out, and way made for the later lessons. The school journey has been so often and fully described as to make any further discussion of it unnecessary.

THE CASE FOR PHONETICS.*

BY B. DUMVILLE, B.A., L.C.P.

I.

HOW often do we hear people say, "I can manage to read and understand a French novel fairly well, but I cannot speak French, nor can I understand French people; they talk too quickly."

It is my constant duty to receive students who have already learnt French for some time, and almost the universal answer to the question, "Can you speak French?" is, "Oh no! we learnt the verbs and the grammar, and translated a book, but we did not learn to speak." Even the reading aloud of a single French sentence is undertaken with a great degree of hesitation by the conscientious student. The more unconscientious person, however, rushes in where others fear to tread, and gives his English sounds with brazen effrontery, imagining that they are good French.

Is it not a lamentable fact that after three, four, or five years' study, English pupils can neither speak nor write French with any degree of fluency? One explanation of this is, that many English teachers of the language cannot

* Extracts from a lecture delivered at the London School Board Offices on Friday, July 18, 1902.

do so themselves. This is often hardly the fault of the teachers, seeing that they are often required to teach a subject willy-nilly, to fill up a gap. Almost every English teacher in a higher-grade or secondary school is supposed to know his "bit of French," and a vacant place on the time-table is filled up by the person who can most conveniently be spared. Only last week I heard of a master in a pupil-teachers' centre being required to teach the subject, although he knew no French whatever. To his credit, it must be stated that he immediately commenced to take private lessons. A colleague of mine tells me an amusing case which occurred in one of our higher-grade schools. My friend has a very fair pronunciation himself, but his ability was passed over by the head-master for another member of the staff, on the ground that the latter had spent a day in Paris, and had therefore brought away some of the Parisian accent with him.

What, then, is the result of requiring men to teach a language which they cannot speak? Is it to be expected that their pupils will acquire a power which they themselves lack? In some subjects it is possible—though not advisable—for a master of strong personality to cause pupils to learn many things of which he himself is ignorant. The teacher may order the boys to learn all the rivers of England, and test them from a map or from a book; but he cannot succeed in making his boys learn French—that is, the spoken language—unless he is able and *willing* to lead the way himself. It is, however, possible to make boys learn to *write out* French verbs and rules, without having a good knowledge of the language one's self; and many a master has succeeded in causing his boys to have a thorough mastery of the written forms, without really teaching them any French at all. For to know French is to have power over the words, to use them in all their combinations freely and easily, in speaking as well as in writing. To secure this, there must be one person *at least* in the class who is able to "make the running." Since every individual has a tendency to preach an ideal arrangement in which his own particular powers will secure a maximum of consideration, it is only natural that English teachers of French should have emphasised the importance of learning paradigms and rules; for it needs only a firm control to obtain such work as this.

Since the teacher can only speak English, his lesson will be in English almost exclusively, and the pupils will mark time from year's end to year's end, writing out paradigms which have no meaning in themselves, and which do not enable the student to use without hesitation the form he requires in a sentence. Listen to an ordinary French lesson, even to an advanced class, and you will hear on the average ten times more English than French. The cry of the English teacher who has little power in French is, "Learn your verbs and your rules." He might often add, "I cannot teach you anything else."

But the Frenchman has usually succeeded little better than his English *confrère*. The reason is not far to seek. He has made little use of the linguistic power he possesses, but has followed on the same lines as the Englishman. Since his control of the class is often less, the paradigms are usually less faithfully reproduced.

I remember vividly my first French lesson. I had been looking forward to the visit of the Frenchman with great interest, but was very disappointed to find that the text-book was entitled "French *Grammar*." My elders told me, in answer to my complaints, that I could not learn to speak or write French without first mastering all the grammar. I spent many years struggling with this grammar, but at the end of them I found my knowledge so unstable that a break of a few months in the lessons was sufficient to cause the essential parts of it to disappear. Subsequently I began to try to speak French with what natives I could meet. From this point my knowledge of grammar began to acquire a more permanent character, and the growth towards a fair mastery of French grammar has, in my own case, been concomitant with the growth of conversational power. In short, grammar has followed on the heels of speaking and writing. After twenty years' experience in learning and teaching, I have come to consider that my childish disappointment had more foundation than either I or my elders imagined. It seems to me that little improvement is likely to be secured until both English and French masters of this subject realise that French is a *tongue*, and that mouth and ear are the first things to which attention must be paid. Instead of continually drawing and redrawing the plans of the house, we must commence to build it. The plans are useful, nay essential, but they are of no use in themselves. Bricks and mortar can alone make them of use. The golden rule should be, "Let as much French be spoken in each lesson as possible, and only a minimum of English—that is, the amount necessary to supply explanations which cannot be given in French." Gradually the proportion of French will increase, and in advanced classes of the third and fourth years we should hear nearly all the explanations given in French. Thus, the pupils will not only be widening their knowledge, but the very means by which advances are made will serve to strengthen and deepen that knowledge which has already been acquired.

Such a system as I have indicated will obviously require those portions of a language to be attacked first which are most generally useful. The ordinary logical order of the grammar book will have to be modified and adapted to suit the order in which materials are required. For instance, pupils will actually begin to learn the irregular verb *je m'assieds* before they have attacked the subjunctive mood of *avoir*.

Obviously, such a method will require, more than ever, that the teacher be able to speak correctly himself. But it should be noticed that, even if we cling to the old methods, correct pronunciation is an essential. For if we are to learn lists of words, paradigms, and the like, we must *say* them. Whether we say them under our breath or whether we shout them out on the housetops, *we must say something*. Try to learn any language, living or dead, without moving lips or tongue, but simply paying attention to the written forms, and you will find it practically impossible. The classical scholar is far more dependent on his mouth and ear than he cares to admit. If, then, in French we must say something, it is far more satisfactory that it should be *French*, and not a hideous combination of sounds neither French nor English.

A large proportion of English teachers of French cannot read half a dozen lines with an absolutely correct pronunciation. Indeed, I have met men who have taught French in secondary schools for many years, and who are indignant at the idea of such a requirement. I have also had students who have duly recited their lines of French poetry in lieu of English at the Government examination, but whose pronunciation was most faulty. I myself remember reading French in an examination, and receiving a high mark for it, at a time when my pronunciation must have been execrable. Such facts as these bring to my mind a tale which I read many years ago. The details have escaped my memory, but the general drift remains. The people of a town were told that a glorious spectacle was to pass through their city, and that only those with a clean conscience would be able to see it. To the evil-minded it would be invisible. When, at length, it was supposed to be passing, with one accord they all burst out with the most extravagant expressions of admiration. At length a little innocent boy exclaimed, "Papa, I can't see anything." A second had the courage to confess the same, and in a moment every one owned that he saw nothing. A similar hoax has been played in many cases with respect to French. Teacher and taught, and it is to be feared some higher personages also, have listened to ridiculous combinations of sounds, and have called them French. It is significant that often the *right* pronunciation of a word, especially if emphasised, awakens considerable merriment.

At last we are beginning to bestir ourselves, and most examinations have now an oral section. When one runs to the ordinary French grammars for help on the matter of pronunciation, one is struck by the variety of the information given. I note, for instance, that the sound of *é* is given by some books as that of the "ay" in *say*, by others as that of the vowel in *air*, by others that of the last syllable of ab*bey*, and by others as the vowel in *pen*. Now it is clear, even to the uninitiated, that these sounds are not all alike; so that if one is right, the others must be wrong. As a

matter of fact, no one of them is exactly correct—at any rate, as produced in Southern English. Many writers give no help in the matter at all. They affirm that the directions given in most books are misleading, and that the correct sounds are only to be acquired from the teacher. They assume, of course, that the teacher speaks correctly himself. Alas! this, in the case of English teachers, is rare. Is it, then, necessary to fall back entirely on native teachers? The obvious answer to this is that the pupils taught by Frenchmen are little superior in this matter to those taught by Englishmen. Yet they have had the opportunity of hearing the right sounds, and it would seem, at first, that imitation would secure the desired result. It might even be affirmed that the reason of non-success is, that they do not hear sufficient French. We are told that, to secure this, one must go to France, and the popular belief is that to speak correctly it is essential to make an extended sojourn in France. I have come in contact with many English who have done this, and I can affirm that in most cases the pronunciation was very faulty indeed. I will give three examples. The first is an English lady who has been married to a Frenchman, and has lived in France for about twenty years. She speaks with great fluency, and understands as easily. But her "accent" proclaims her an Englishwoman at the first sentence. In all probability, another twenty years will make little, if any, change. The second is a friend of mine who forced himself on my attention some three years ago by ridiculing phonetics, and pointing out that he got his pupils to read very well indeed without any trouble about such technicalities. I ventured to ask him whether he spoke correctly himself. He replied that he had been told by his French friends that he spoke exactly like a Frenchman. I asked him to pronounce several of the most common words, such as *avoir* and *feu*, and pointed out that his rendering of these was incorrect. He defended his pronunciation for a while, but is now an enthusiastic and successful teacher on phonetic lines. The third was a lady who came to a class in phonetics with a very poor pronunciation, although she had spent one and a half years in France. She acknowledged that in six months of phonetic training she had made more progress than during the whole of her stay in France.

The truth is that it is not sufficient to hear a Frenchman speaking correctly. We cannot imitate exactly. Any one who has tried to learn the pronunciation from a Frenchman knowing nothing of phonetics, though speaking perfectly, cannot fail to have had some very painful experiences. He has tried and tried, again and again, with such encouragements as the following:—"Now you have it nearly;" "Try once more;" "Not quite so good;" "Now listen to me;" "You have it now;" "No, you've lost it again." What does all this mean? It means that the Frenchman produces the sound perfectly from long usage, but that he does not know *exactly* what he does with his tongue, jaws, lips, and soft palate. Indeed, when he does try to explain, he often misleads rather than helps his pupil. A very amusing illustration of the prevailing ignorance of the most elementary principles of phonetics, even among the educated, has been furnished by M. Zünd-Burguet.* He took as his "victim" an eminent young barrister who speaks French with remarkable purity. "What do you do to pronounce 'ba'?" demanded M. Zünd-Burguet. His friend pronounced the syllable several times, and replied, "Je ferme la bouche et puis je l'ouvre." "And what do you do for 'pa'?" asked the phonetician. Again, after several repetitions of the syllable, the young barrister declared, "Ma foi, je ferme la bouche et puis je l'ouvre." "And what for 'ma'?" continued the importunate questioner. Once more the lawyer set himself to pronounce the particle, and again he replied, "Mon Dieu, c'est la même chose: je ferme la bouche et puis je l'ouvre." This ignorance is at least as general among English people with respect to the English sounds they are using every day. If we ask several people how many separate vowel sounds are required to speak English properly, we shall probably receive many different answers, the greatest amount of agreement being probably on the number *five*, which is the farthest from the truth. Englishmen are shocked to learn that they frequently drop *h* in words where it is called aspirate, although the invariable pronunciation of it by another, as a foreigner, would strike them as peculiar. Now those who have to teach the sounds of the English language should at any rate know *how many sounds* they have to work at, and an elementary knowledge of phonetics should be part of the equipment of all teachers of English.

But we shall be answered that most English and French children grow up to speak their native tongues with tolerable accuracy, and that simply by imitation. If, then, the Frenchman has succeeded in speaking French in this way, cannot the Englishman follow in his footsteps, if only he will spend enough time in listening and endeavouring to imitate? An argument of this kind overlooks a most important point. When a child comes into the world his vocal organs are undeveloped and ready to move in a variety of ways. The force of imitation leads him to make innumerable shots at the sounds he hears around him. Gradually he arrives at the right sounds, and gradually, too, his organs take on definite habits of movement. These habits have an organic basis. The muscles of the tongue and lips become modified to enable them to perform with precision the exact movements necessary. When the child reaches maturity, he is no longer in the same position for a new language as he was when a baby. His organs, *unless trained by definite effort to move otherwise*, will persist in moving as of old, and when he wishes to imitate a sound in a foreign tongue, he will give the nearest approximation of his mother tongue. The nearer that approximation happens to be, the better for his rendering; but even fairly close approximations, which *one by one* seem almost the same as the foreign sounds, will, when multiplied in every sentence, produce *an aggregate of difference* which will grate on the ear of the person to whom the foreign tongue is habitual.

If, then, we desire a correct pronunciation, we must know what exactly are the positions, and then exercise ourselves frequently in producing them. When we can produce them the battle is scarcely half over; for it is not sufficient to be able to produce them by an effort—and, in several cases, it will have to be a *great* effort at first—we must be able to produce them easily, quickly, and at the last quite unconsciously. When we are speaking or reading, we have not the time to think and make a special effort for each vowel and each consonant. We must acquire complete control over most, so that we can give some attention to the more difficult ones. Our specialised exercises will bear the same relation to a finished pronunciation as five-finger exercises and scales do to the brilliant performance of a difficult piece of music.

Of what special use, then, is the study of phonetics? First, it is an immense saving of time; and, secondly, it enables a foreigner to produce sounds which he would probably never succeed in producing without such a training. A person with a good ear, an excellent command of the vocal organs, a retentive memory, and a keen desire to improve, will acquire a *fairly* good pronunciation by residing in France from one and a half to two years, even without the aid of phonetics. But, *as far as pronunciation is concerned*, it is not an exaggeration to say that the same person will arrive at an equally good result in three months under the tuition of a phonetic expert, such as M. Zünd-Burguet of the Alliance Française. Given, then, the desire to acquire a tolerably correct pronunciation of French, much labour can be saved by a careful study of the various positions of the jaws and tongue, and of the part played by the nose. This preliminary training, however, requires considerable time. The symbols are practically useless in themselves. Each of them represents a certain *definite* position of the organs of speech. In several cases, this position can only be gained *with ease* after long and painful practice, since—as has been explained above—the organs have "grown" into certain English ways of moving, which render it extremely difficult to put them into the new positions. So it is that some English people never acquire a really good pronunciation of a foreign language, even after many years spent in the country in which that language is spoken.

(To be continued.)

* Directeur du Gymnase de la Voix, Paris, and formerly lecturer on French Pronunciation under the Alliance Française.

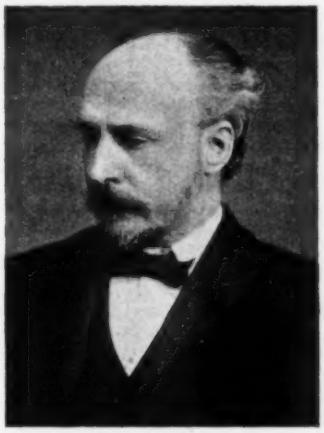
THE BRITISH ASSOCIATION AT BELFAST.

THE PRESIDENT: PROFESSOR JAMES DEWAR, F.R.S.

The British Association and Teachers.—The autumnal gathering of the English fathers of science and technology has always had great interest for thinking teachers; for it has undoubtedly been a great factor in the educational development of the country, especially on the weak side, which, until the last decade, was, as even the man in the street knows, the science side, and which, as Professor Dewar pointed out at Belfast, is still greatly neglected in England, with only 1,500 practical chemists watching over our factories, as compared with Germany with its watchful army of 4,500 specialists. But at the Glasgow meeting of 1901 the Association took a step which definitely and categorically declared education to be one of the great questions concerning which a special discussion must take place at every annual meeting, in a special section, under a special president. Hence practical teachers will read the transactions of the Association with redoubled interest, now that an educational section is an established fact.

The President.—Scotch practical teachers had full confidence in the *nous* of the president, for did he not hail from the land of cakes and calibre? It is true that to the uninitiated the name of Dewar is suggestive of whisky rather than of wisdom, but to those within the inner circle the wisdom and knowledge of Professor James Dewar were matters of common knowledge.

Who the President is.—If the meetings of the Association had been held a few days later, the president might have



PROFESSOR JAMES DEWAR, F.R.S.

celebrated his birthday in the presidential chair, for he was born on September 20, 1845, at Kincardine-on-Forth.

His Education.—He was educated first of all at Dollar Academy, whence in the fullness of time he passed to Edinburgh University, coming there under the spell of Lord Playfair, the tutor of the King. It was not long before chemistry counted him as her faithful devotee. Not only did he drink in chemical enthusiasm at Edinburgh; he also was inspired by the great Belgian savant, Professor Kekulé—to whom the world is indebted for most of what is now accepted to-day concerning the ring theory of carbon compounds—as he attended the classes of that master of chemistry at Ghent.

His Work.—Professor Dewar's first appointment must have been an eminently congenial one. It was that of assistant to Lord Playfair, whom, in due course, he succeeded as professor at Edinburgh University. The new professor soon showed himself a worthy occupant of the Chair of Philosophy. In 1875 he was made Jacksonian Professor of Natural Experimental Philosophy at Cambridge, and became a Fellow of the College of Peterhouse, which was always, and is to-day, the nursery at Cambridge of scientific thought.

In 1877 he succeeded Dr. J. H. Gladstone as Fullerian Professor of Chemistry at the Royal Institution. How worthy a successor of Davy and Faraday the Scotch savant has shown himself to be, is matter of common knowledge.

It was in accordance with the fitness of things that the Chemical Society should elect Dewar as their president. He also became President of the Society of Chemical Industry, and a Fellow of the Royal Society.

For the Nation.—From 1888 to 1891 Dewar sat on the Explosives Committee of the House of Commons, one outcome of which was the famous cordite explosive, which was the joint invention of the lately deceased Sir Frederick Abel and the subject of this sketch. Again, from 1893–4 he served the nation as member of the Committee on Water Supply. Readers of *The Chemical News* and other scientific papers will know that to-day the president, in conjunction with Sir William Crookes, holds a watching brief for the London County Council concerning the water supply of London. He it is that counts the number of germs and notes the amount of organic and inorganic matter present in the water that Londoners consume; so that if the anarchist whom H. G. Wells painted as endeavouring to steal cholera bacilli in order to devastate London were to succeed in his ghoulish work, we should have early word of the attempt from Professor Dewar and Sir William Crookes.

His Triumphs.—Stimulated, no doubt, by his communion with Kekulé, Professor Dewar's first attempts at research work had to do with organic chemistry, as several learned memoirs testify. He then turned his attention to the supposed solid alloy of hydrogen with palladium, to which its creator, Dr. Graham, the last of the Masters of the Mint and one of the greatest of English chemists, gave the name hydrogenium, a name which now only serves to mark a fallacy. Little did Dewar dream then that he would be the lucky chemist to prepare really solid hydrogen. Passing on, we find Dewar working with M'Kendrick on the chemistry of the electric arc, a branch of work which Moissan, with his electric furnace, has now staked off as his peculiar claim. Spectrum analysis next claimed the professor as its disciple; but behind all this work there always apparently lurked a yearning for low temperature research work, with which his name will ever be honourably connected in the annals of chemistry.

The Liquefaction of Gases.—In 1874, James Dewar read a paper before the Chemistry Section of the British Association on the Latent Heat of Liquid Gas; and when, three years later, the world of science was startled by the announcement that Pictet of Geneva and Cailletet, working independently at Paris, had simultaneously succeeded in liquefying oxygen and hydrogen, there is no doubt that James Dewar was one of the most zealous students of the new discovery. Indeed, in 1878, he repeated the experiments of Pictet and Cailletet at the Royal Institution; and when, six years later, Wroblewski and Olszewski made further advances in the liquefaction of oxygen and hydrogen, Professor Dewar repeated their experiments, and illustrated the process of the liquefaction of air. But these attempts at producing liquid air were puny in the extreme. All that resulted from them was a dimming of the surface of the receiving vessel, and therefore there was no possibility of examining the product to ascertain its properties.

The Triumph of the Scotchman.—It is the peculiar triumph of James Dewar that he so modified and perfected the apparatus suggested by Olszewski as to produce *liquid air by the pint.* This was in 1891, and the next year he invented the vacuum jacketed receiver, wherein liquid air can be kept without evaporation for a considerable time, and whereby its properties can be easily ascertained.

Dewar's next triumph was the liquefaction and solidifica-

tion of hydrogen, and the attainment of the lowest temperature ever produced or experienced, and below which it is highly probable we shall never go.

As a recognition of his work on the liquefaction of oxygen and hydrogen, the Smithstonian Institution of Washington, U.S.A., awarded the distinguished chemist the Hodgkins Gold Medal, Professor Dewar being the first holder of this Transatlantic distinction. He had already been the recipient of the Rumford Medal from our own Royal Society in 1894, so that it cannot be said that the prophet is without honour in his own country.

In selecting so eminent a man as its president, the British Association honoured itself as well as Professor Dewar.

As to the address on technical educational enterprise and low temperature possibilities, we need hardly say that it was worthy of the reputation of the great chemist who delivered it, and of the occasion, but it was of too technical a character for us to discuss here.

That Professor James Dewar may live long and flourish mightily in his chemical researches until he obtains the desire of his heart—namely, absolute zero—will be the wish of every Briton and especially of every Scotchman, and it is certainly the earnest aspiration of his respectful admirer, the writer of the present article.

OUR SPECIAL CORRESPONDENT'S NOTES.

THE gathering of the scientific world in its annual parliament has not this year been marked by any very special feature, unless it may be taken to show a tendency to allow the work to pass more and more into the direction of the younger men. Many of the seniors whose faces have long been so familiar have been missing, and more of the newer workers have come consequently to the front. The recent death of Sir Frederick Abel was the subject of much melancholy comment, and the loss of the assistant-secretary, Mr. George Griffith, was very generally and very severely felt.

The meeting was on the whole a very successful one, but the numbers attending it fell below those of last year. This was principally due to a falling off of the local support.

The tendency to subdivision and the consequent formation of new sections received a check. There was in many quarters a wish to separate astronomy and cosmic physics from Section A; but it was decided not to do so, but rather to consider it as only a sub-section of the latter.

Science Subjects in Schools.

Among the important work done in the Educational Section, notice should be taken of a remarkably interesting discussion that took place, on the initiative of Dr. Kimmins, as to the best science subjects for both boys and girls, and their order in the school curriculum. While admitting the importance of elementary physical and chemical science, and setting forward prominently the advance or reform which recent years have seen in the methods of instruction in it, he pressed strongly the claims of biological studies for recognition, and advocated the view that they may be taken at an earlier age than the others, forming, indeed, a link between the latter and the kindergarten. According to this plan, a scheme of science study suitable for general adoption would involve some such distribution of time as the following:—

Kindergarten—5 to 8 years. Natural history—8 to 10 years. Botany—10 to 12 years.	Boys and girls.
Elementary experimental science—12 to 14 years. More advanced experimental science—14 to 16 years.	Boys.

With a possible modification for girls.

Elementary experimental science—12 to 14 years.
More advanced botany—14 to 16 years.

In the discussion that followed the paper this scheme met with general favour, but a good deal of difference of opinion was found to exist as to the position of natural history, or, as most preferred to call it, "nature study." The general feeling of the section was that in the present position of studies the majority of the science teachers in the schools would be found ill-prepared to take it in hand with much prospect of success.

The Study of Hygiene.

The position of hygiene as a school subject was another matter that was under consideration. The nature of hygiene, and its bearing upon the common experiences of life, seem to make it eminently desirable that it should be studied. Much is to be said from this point of view in favour of regarding it as much as a means of training the mind to observation and reflection, as of instilling into the children useful knowledge of the laws of health for their own sake. In the section both aspects of the question were put prominently forward by teachers of experience, the general feeling appearing, however, to be in favour of putting it at the end of the science course, and teaching it almost entirely for its intrinsic importance and its bearing on the problems of everyday life.

Higher Commercial Education and the Universities.

The recent efforts made by the newer universities to secure the inclusion of commercial subjects in their curricula were the subject of an important discussion in the Economic Section. It was introduced by Dr. W. R. Scott, who contributed a paper entitled, "The Position of Economics and the Applied Sciences in the University Training of Men intended for a Commercial Life." He pointed out that higher commercial education must provide a suitable training for persons who aim at discharging the duties of responsible positions in business; and as such education must embody the principles of subjects taught, it falls within the sphere of the university, technical colleges dealing rather with the application of the principles than the principles themselves. The study of science and its application to industries, important as it is, is not a complete commercial course, needing to be supplemented by a considerable attention to the problems of economics. There is a danger at the present day in England of falling into the opposite extreme, and putting forward the extension of the study of economics and political science as the ideal higher commercial education. The author of the paper advocated a careful combination of the two schemes, securing training in both directions, and drew attention to the proposals of the Scottish universities set forth in the new curriculum, whereby the course of study is arranged so that in every case the student will enter on the applied part of his course after having acquired a sufficient acquaintance with the principles of the subjects which he makes the centre of his studies.

The Appreciation of Stimulation by Plants.

The most remarkable communication to the Botanical Section was made by Professor J. Chunder Bose, an Indian physicist who has been investigating the electrical phenomena which can be observed when various parts of plants are stimulated in various ways. It is well known by physiologists that when an electrical shock or a chemical or mechanical stimulus is administered to a nerve in organic connection with a muscle, not only does the muscle contract, but an electrical disturbance is set up which can be made visible by means of a galvanometer. No contraction of a piece of ordinary vegetable tissue is of course possible under such conditions, but Professor Bose has found that the electrical disturbance is set up with great readiness, and that the record which can be taken of it corresponds with great closeness to that which can be observed in the animal tissue. The effect of stimulating living vegetable substance is consequently quite comparable to that of exciting muscle and nerve. The two classes of sensitive substance are affected in the same way by chloroform and other anæsthetics, and by various poisons. The result of continuing to stimulate the vegetable tissue is to induce fatigue, just as it is in the case of muscle. Professor Bose exhibited the apparatus he is in the habit of using, and demonstrated the different effects he has obtained, before a crowded audience. He claims to have brought forward another proof of the essential identity of vegetable and animal protoplasm.

The New Star Nova Persei.

The circumstances attending the appearance of this new star, which attracted much attention comparatively recently

together with the peculiar features of the star itself, were the subject of much discussion in the Astronomical Sub-Section. Mr. Hinks communicated a paper on the nebula surrounding the star, and showed that it has an apparent motion which, putting the most probable estimate of its parallax, would give a velocity similar to that of light. He showed on the screen a series of photographs of the nebula, demonstrating its changing appearance, and some diagrams illustrating the theory that the changes were due to the light from the star illuminating each portion of an otherwise dark nebula as it reached it. Dr. Roberts showed some photographs he had taken of the star itself, and suggested that the luminosity might be due to the stirring up of a dark nebulous cloud by the motion of the star. The consequent collisions would cause the luminosity, which would appear to move as the disturbance spread. Other well-known astronomers and mathematicians took part in the discussion.

The Influence of Civilisation on the Discrimination of Musical Tone.

In connection with the expedition of Professor Haddon and his colleagues to Torres Strait and New Guinea, a series of investigations was made for the first time on the different psychical peculiarities of the natives. Dr. Myers made a communication to the physiological section dealing with one of these—the discrimination of differences of musical tone. To illustrate his subject, he compared the people of Torres Strait with those of Scotland. The investigations were conducted by means of two tuning-forks, vibrating 256 times per second. One was kept normal, while the other was fitted with a sliding clamp, which allowed the number of vibrations to be reduced at will. The subject sat in front of the experimenter, but did not see which fork was sounded. The education and musical training of the Torres Strait children was similar to that of English children. The least perceptible tone-difference distinguished by the children of Murray Island was not widely different from that distinguished by the Aberdeen children, but the latter improved with practice more rapidly. The adult islanders had little knowledge of music, and most of them failed to detect a semitone interval at first. As to vibration frequency, the adults of Aberdeen distinguished an average of nine vibrations at their first sitting, while those of Murray Island only managed a difference of fifteen. The detection of frequency distinguished by the Torres Strait children averaged five to twelve, while the Scotch achieved five to nine. The results were interesting from the standpoint of comparative music, because if third and quarter tone music were widely spread, one would expect a high sensibility to minute alterations of pitch. This is evidently not the case as far as the Murray Islanders are concerned.

Suspension of Life at Low Temperatures.

It is now about four years since it was first demonstrated by Brown and Escombe, and subsequently by Dyer and Dewar, that seeds were capable of withstanding submission to the temperature of liquid air and liquid hydrogen without losing their power of germination, so that evidently this enormous degree of cold did not destroy their life. Since these papers appeared, much investigation has been made on this power of resistance possessed by vegetable protoplasm, and a very important communication was made by Professor MacFadyen and Dr. Rowland on their experiments with bacteria. These organisms were chosen on account of their simple structure, consisting, as they do, of only a small portion of protoplasm surrounded by a thin, delicate cell-wall. The authors had subjected various forms to very low temperatures, first to – 190° C., and subsequently to that of liquid hydrogen, – 252° C. They were kept exposed to this temperature for six months, samples being taken at intervals. It was found that though the ordinary manifestations of life ceased at zero, and there was every reason to believe that at – 190° C. intra-cellular metabolism also ceases, yet the exposure for so long a time to such a temperature was without appreciable influence on the vitality of the organisms in question. The authors concluded a very remarkable paper with the words: "It is difficult to form a conception of living matter under this new condition, which is neither life nor death, or to select a term which will accurately describe it. It is a new and hitherto unattained state of matter—a veritable condition of suspended animation."

An "All-Stations" Express.

In the Engineering Section a possible development of the electric train system was sketched by Mr. John Brown, F.R.S., which possesses considerable interest. The express is an electric train consisting of a number of corridor carriages, each of which contains a separate motor, and is labelled for a station on the line. When a passenger has obtained a ticket he steps into a carriage, which starts from the station shortly before the express is due. The latter, coming through, catches the carriage, which then becomes part of the train. With electric motors it would be possible to do this without any risk, for there should be no more difficulty in catching a coach in steady motion than there is in bringing an engine gently up to one at rest. When the train is passing a station, the rear carriage is slipped and brought to rest at the platform. The advantages of this arrangement are that stations require simply to be long enough to accommodate a few carriages instead of a long train (an important matter on underground lines especially), that less power is wasted in starting and stopping carriages, and that the load is almost steady. The author exhibited a model of a signalling device by which the driver of a train could tell how far he was from a carriage. A galvanometer in each carriage is connected with an insulated conductor containing resistances spaced at equal intervals. The other terminals are connected respectively to the positive and negative wires carrying the current. As the carriages approach, resistances are cut out, and the galvanometers indicate the interval separating the vehicles. A working model of the proposed train was exhibited in the grounds of Queen's College.

The Training of Engineers.

Educational subjects at Belfast were by no means confined to the new section specially devoted to their consideration. The question of training workers in all fields of science has been anxiously discussed in section after section. It seems as if the diversion of some of the most important of our industries to German workshops, and the continual development of other industries under the German system of education, have at last made English men of science seriously uneasy. One of the most important indictments of our educational system was brought forward by Professor Perry, and was directed against the training of our future engineers. The attention of the authorities of schools may well be directed to his presidential address in the Engineering Section. Criticising the results which are being obtained in the schools of applied science, which have sprung up in large numbers in recent years, he said that he had found that only a few of the men who leave them every year are likely to become good engineers, and that the most important reason for this is that the students who enter them come usually from the public schools. These young gentlemen cannot write English; they know nothing of English subjects; they do not care to read anything except the sporting news in the daily papers; they cannot compute; they know nothing of natural science; in fact, they are quite deficient in that kind of general education which every man ought to have.

General Features of the Meeting.

The Belfast meeting has, on the whole, been a successful one. The numbers in attendance finally fell little short of 1,700, which, though far below those of Manchester some sixteen years ago, yet will compare not unfavourably with those of most provincial meetings. The evening lectures were given by Professor J. J. Thomson of Cambridge, on the Becquerel Rays and Radio-activity; by Professor W. F. R. Weldon of Oxford, on Inheritance; and by Professor Miall of Leeds, on Mosquitoes and Malaria. All were extremely well attended. The usual conversaziones were held, one of them being made the occasion of the formal opening of a new fernery in the Botanic Gardens. It was decided to meet at Southport next year, and to visit Cambridge in 1904.

EDUCATION IN THE UNITED STATES OF AMERICA.

SPECIAL REPORTS ON EDUCATIONAL SUBJECTS. Vol. X.

"A well-instructed people can alone be permanently a free people."

The Disagreement of the Inquiring.—Herbert Spencer, whose inspiring little book on education is studied much more generally by American than by English teachers, tells us that "whatever may be thought of theological dissent, it is clear that dissent in education results in facilitating inquiry by the division of labour," and that "of the three phases through which human opinion passes—the unanimity of the ignorant, the disagreement of the inquiring, and the unanimity of the wise—it is manifest that the second is the parent of the third." It is this hope of arriving at the perfect method, by way of diverse yet, withal, enthusiastic experimentation, that lends so potent a charm to the educational unrest of our Transatlantic cousins, and the burden of Mr. Sadler's tenth volume is undoubtedly the hopeful disagreement and open-mindedness of the American superintendents and teachers.

Contents of Vol. X.—As it will be possible to give only the merest glance at this book of upwards of five hundred pages, we will begin by setting out the contents, as giving the briefest if not the best summary of what is contained in Mr. Sadler's latest report, the price of which, by the way, is 2s. 3d.

Sir Joshua Fitch contributes an introductory note, setting out why we should study American systems of education. This is followed by a section of nearly two hundred and fifty pages on "Moral Education in American Schools," from the pen of Mr. Mark, Master of Method, Manchester Day Training College. The next six sections, on the School Systems of the United States as a whole, and on those of Chicago, New York, Boston, and St. Louis, are by Mr. A. L. Bowley, of the London School of Economics. To these succeed "The Public School System of Philadelphia," by the superintendent thereof, Mr. Ed. Brooks; "The Minnesota System," by Professor Kiehle, professor of pedagogy of that state; "School Attendance in the United States of America," by Mr. Twentyman, Mr. Sadler's assistant; "Some Points of Interest," by Miss Ravenhill, Domestic Economy Inspectress to the West Riding County Council; "The Training of Teachers in the United States of America," by Miss Findlay, of Southlands Training College; "Teachers' College of Columbia University," by its Dean, Dr. Russell; and fifteenth and finally, "Nature Study in the United States of America," by Mr. Herger Wallace.

Not one and indivisible in Education.—The fact that "America is a confederation of self-governing states, each of which, by the terms of the Act of Union of 1789, retains all the prerogatives and powers of a sovereign state that are not expressly relegated to the Government of the United States by the language of the constitution," must be borne well in mind in reading these reports, especially as "education is one of the public interests which thus belongs exclusively to the separate states." "Theological instruction in any form is absent from the common school. The co-operation of the churches is not sought by any of the local legislatures, and the ministers of religion have, as such, no share in the control of those schools."

The Problem.—This is to Americanise the ever-arriving immigrant, to weld the races and the classes in building up an intelligent democracy; and it is to the schools that the people look—and, be it added, not in vain—to accomplish assimilation of diverse elements, so that all, whilst nourishing a kindly feeling towards the land of their origin, shall vie with each other in patriotic appreciation of the land of their adoption. This in itself suffices to make the ethical side of education, which alone can control the civic side, of prime importance. Training for citizenship is ever present in the American teacher's mind, and the country does not fail to appreciate the school teachers, who do such yeomen service to the States at large.

A Bureau and a Commissioner of Education.—In 1867, it is true, there was created at Washington a Bureau of Education under a Commissioner, the present holder of that office being Dr. W. T. Harris; but he merely collects statistics and makes reports to Congress. The bureau has no statutory power whatsoever.

Moral Education.—*The English and the American school is founded on the idea that moral education is more important than intellectual* (Dr. Harris). This, at the outset, is high praise for both America and England, and the first thing that the tenth volume does is to show how earnestly our American brethren of the chalk and duster strive to make their moral teaching as sound and as perfect as possible. Those who are clamouring for sectarianism in English schools will perhaps be astonished to learn that America, religious even to fanaticism though she frequently is, does not enact, or even encourage, religious teaching in the common schools.

The Rich and the Poor.—For the son of a Prime Minister to sit cheek by jowl on Board school benches with the son of a peasant would in this country be an impossibility. In America it is the rule; and it says little for European democracy to state that it is only in the eastern and Europeanised States that there is any desire to depart from this laudable custom.

Education and Crime.—The cry that education makes accomplished criminals is heard in the States as well as here. Americans say that if a greater proportion of the people are educated, a greater number of the criminals will cease to be illiterate. It is the proportion of literate criminals to literate non-criminals that must be considered, and this consideration effectually silences the traducer of education.

An interesting account is given of the University Elementary School, Chicago, into which, however, we cannot enter.

Methodology in Moral Instruction.—Morality is taught by direct and by indirect methods, and the report is replete with information under both heads. Generally speaking, the aim is to make the children *self-respecting* and *self-governing*, little reliance being placed upon repression, and much less upon bodily chastisement. The teacher leans upon his or her personality.

Direct Moral Teaching.—The opinions of school superintendents are fully quoted, and every information is given as to the procedure of different teachers in their various schools. From these it appears that the direct teaching of morality assumes the following forms:—(*a*) The cultivation of special virtues, such as duty to parents, to brothers and sisters, to playmates, to the aged, to the poor and unfortunate, to the ignorant and stupid, to strangers and foreigners, to the public, to one's country; home manners, table manners, school manners, street manners, manners in public assemblies and in public conveyances; industry, punctuality, order, economy, honesty, truthfulness, cleanliness, self-respect. (*b*) The morning exercises at the opening of school are so arranged as to subserve this end. (*c*) Class mottoes or quotations are chosen, and the children are encouraged to live up to them. The teaching of civics, of course, lends itself powerfully to the teaching of the special virtues connected therewith, and civics means much more in America than in England. Particulars of this teaching are given in detail.

Indirect Moral Teaching.—Under this head we have (*a*) literature, (*b*) art, (*c*) manual training, (*d*) nature study, and (*e*) music. We need scarcely enter into particulars, as English schools recognise these adjuncts to character training just as clearly as do American schools.

Curriculum.—Under this head Mr. Mark draws attention to what is regarded by Americans themselves as a blot. So intent are teachers and their trainers upon getting into the proper sympathetic attitude demanded of them as teachers of *little* children, on the lines of Pestalozzi and Froebel, that they have not remembered that a wider curriculum and altered methods are needed when dealing with children of twelve or thirteen years of age, and it is contended that these latter do not get the profit from their schooling that

they should do. With this is connected the moral danger that the energy of the children is not evoked.

The Kindergarten.—Nowhere in the world is Froebel more popular than in the States, and nowhere is there more zeal in carrying out what the teachers conceive to be the principles of the German sage. That this conception is not always true, and that its materialisation is not always perfect, may be said of England or Germany as well as of America.

The Playground and Vacation Schools.—To Stow the playground was the "uncovered schoolroom," whose disciplinary influence was of great value. This is also the doctrine of many American teachers, who favour directed games and playground supervision.

Those practical teachers who watched with interest the vacation school which, under Mrs. Humphry Ward's auspices, has lately been tried—not unsuccessfully—in London, will like to know that state-supported vacation schools are a matter of course in populous urban areas such as New York and Chicago. The recreative side of such schooling is naturally most pronounced, excursions, swimming, nature study, and manual work being the chief items of the programme. Special teachers are appointed, and a special salary is given, so that there is happily no fear of a degeneration of the scheme into a holiday-deprivation and extraneous task-imposing bogey for teachers.

The Training of Teachers.—This, as might be expected, is made much of; and just as in the case of the new London County Council Training College, where a university degree is to be the rule and not the rare exception, so also in the States there is, and always has been, a close connection between the training college and the university. In this connection the appendix on the Teachers' College at Columbia University, New York, is very interesting reading.

Coloured Schools.—Those of us who remember the refusal of certain Americans to dwell in the same London hotel as some coloured ministers of the gospel, will rejoice to hear that such intolerance does not obtain in the schools; nor is any case made out for separate schools, except because of the inability of the negro to keep pace with his white classmate after the first few preparatory years have elapsed. Separate schools do exist, and a high compliment is paid to the worth and work of their coloured teachers.

Truant Schools.—Of these it need only be mentioned that in the States, as in England, the aim is to keep the truant out of the reformatory and remote from all taint of crime, and to reform him by anti-brutal methods. The George Junior Republic, which is a suburban colony of undesirables conducted by Mr. and Mrs. George, and of which a most interesting account is given in the appendix, strikes us as eminently practical and splendidly charitable. We should like to do homage to the warm heart and to the clear head of Mr. George, who is happy only in the company of the undesirables whom he is fast making desirable.

The Educational Press.—A compliment, not undeserved, is paid to the American educational press. We have long been familiar with these well-conducted American journals of education, but it is quite another branch of educational literature that has long excited our envy, and that is the books on pedagogy that are so eagerly bought by American teachers. They contrast most favourably in this respect with their English colleagues, who read very little pedagogic literature, and whose teaching suffers accordingly.

Conclusion.—We should like to hold forth on the excellence of the appendices, but the editor's warning look forbids, and we must leave this tenth volume, as we have invariably left the nine preceding ones, feeling that not a tithe of what might and should be said has found utterance. But then, dear reader, the price of the book is fortunately not prohibitive, wherefore if we have but whetted your appetite, you may fully satisfy it by buying the report, and surely you will have good value for your money.

THE President of the Board of Education has appointed James Walker Hartley, M.A., of Trinity College, Cambridge; Benjamin Beck Skirrow, M.A., of University College, Oxford; and Frederic William Westaway, B.A., of London University, to be inspectors under the Board of Education.

TEACHERS AND THE SUMMER EXTENSION MEETINGS.

ACCORDING to a smartly-written article in *The Saturday Review* of a few weeks back, the chief benefits students derive from the Summer Extension Meetings—at all events those which are held at Cambridge ("biennial picnics," as the writer scornfully calls them)—are three in number:—Firstly, a sort of "extended glibness"—that is to say, a sort of superficial acquaintance with many subjects and a true knowledge of none; secondly, so great a relish for "intellectual tit-bits" that the relish for more solid mental food is grievously impaired; thirdly, an alarming amount of conceit. "If Socrates was the wisest of men," says the writer, "because he knew that he knew nothing, where in the scale of wisdom do the Extensionists come, who are taught to think that they know something of everything?"

Now, I fancy that most of those who have been present at a summer meeting will smile a little at the very superior tone of the writer, and will think it an amusing but somewhat superficial view of the case. Still, there are others, who have never attended a meeting of this kind, to whom this article, with its cheap satire and easy scorn, will make a powerful appeal. They will be tempted to believe that the writer really knows what he is talking about, and will feel inclined to shun Extensionists henceforward as creatures whose unparalleled conceit is only equalled by their astounding ignorance.

As a matter of fact, however, the truly awful deterioration of mental and moral character that this article so feelingly shadows forth is a myth—a perfect myth. I will not deny that the students at these meetings are in the way of gaining a good deal of more or less valuable information upon a variety of subjects, and that to a small percentage the results may be nothing more than "extended glibness." These are the people who in other circumstances would climb the Swiss mountains merely for the pleasure of adding other names to the list on their *alpenstocks*. They are, however, in a very small minority, and to the other students the wide and varied list of subjects, ranging from Music to Economics, and from Astronomy to Architecture, is chiefly welcome in that it enables almost every one to gratify his own particular taste, and yet to gain a sympathetic insight into subjects which, in the ordinary shackles of everyday life, are somewhat beyond his range. To teachers, who are so often compelled to "specialise," this opportunity of broadening their knowledge, and of seeing their own pet subject in its true proportion in relation to the rest, is simply invaluable. If classics are one's forte, it is not uninstructive to attend one of the discussions which are held so frequently at these meetings, and to hear classics treated in an off-hand fashion as the "antiquated system of training in vogue in bygone centuries," while modern languages are glorified as "*the thing* nowadays." If, on the other hand, one is a teacher of modern languages, it is peculiarly edifying to go to another discussion and be told, "Oh yes! modern languages are all very well in their way; but for the best training for a child's body, soul, and spirit there is *nothing* like nature study;" and so forth. Each "specialty" in its turn gets a wholesome snub or two; and though it is certainly not always pleasant, and sometimes a little disconcerting, to have one's cherished studies so roughly treated, it is unquestionably, as we tell our pupils, "good" for us.

As for the second accusation, to that I cannot agree. After all, "intellectual tit-bits," like other dainties, are all right in their proper place, and there seems no more reason to apprehend that the majority of students will henceforth like nothing else, than there is to fear that an ordinary company of adults will in future refuse the more solid sustenance of meat and pudding, because they have partaken of the sweetmeats and fruit at dessert. After all, a good proportion of Extension students are "out on holiday." Teachers or not teachers, many of us are but snatching a brief rest and change before going back to the serious and absorbing business of our daily occupations. If we find, then, that our most profitable and pleasant form of recreation consists, not in putting aside intellectual labour altogether, but in leav-

ing for a while our usual grooves and deep-ploughed furrows, and in sporting in "fresh woods and pastures new," why should we be accused of superficiality and of dislike for real work? We enjoy in these fresh fields of knowledge the charm of a new outlook—all the more keenly, perhaps, that we know our true sphere of labour lies otherwhere. Here and there, to one or other of us, there may be revealed a land where his labour may be carried on with the chance of a fuller, richer harvest than he has hitherto reaped; but the majority of us return in due course to the scene of our daily toil, no poorer for having realised once again that there are in the world of knowledge many other fields as rich, as profitable, and as carefully tended as our own. We are no longer under the temptation, like the pig in the old story, to consider our particular "farmyard" as "the whole world."

As for the "conceit" which forms the third charge against the unlucky Extensionists, I cannot say that students at the Summer Meetings are more deficient than other people in the quality which so many of us unconsciously dignify to ourselves as "self-respect," but I cannot acknowledge they are by any means conspicuous for it, and I absolutely deny that they are *taught* it. Never does one realise so clearly how many beautiful and interesting subjects one is shamefully ignorant of, as after one of these Summer Meetings. While one "sits at home in ease," one may persuade oneself, "All I don't know isn't knowledge;" or, to put it more correctly, that the things one doesn't care about and hasn't much knowledge of are in themselves dry and uninteresting. After a course of lectures at a meeting of this kind—lectures given by specialists and enthusiasts in their various branches of study—it is impossible to hold that pleasant little theory any longer. Another of one's comforting self-delusions has gone! These lectures might cause a fit of "intellectual greediness," which in its turn might produce an attack of mental indigestion, save that the stern facts of everyday life and work would soon warn us to curb our mental appetite. But that they could cause *conceit*—never! *Depression* would be nearer the mark, perhaps—a depression at the thought of one's own small store of knowledge, which only the presence of many hundreds of others as ignorant, or nearly as ignorant, as oneself would tend to relieve.

I think I have now made it sufficiently clear that the Summer Meetings offer at least one advantage to teachers, in that they tend to widen our horizon, and help us to guard against that tendency to unduly appreciate our own stock of learning to the disadvantage of our neighbours', which, I fancy, most teachers recognise as an especial danger, set, as we are, like "the one-eyed among the blind." Still, there are also other—and, perhaps some will think, more solid—advantages which teachers may gain by attendance at a meeting like the one just held at Cambridge. Besides discussions on subjects of educational interest, such as "Hygiene in Schools," "Nature Study," "Village Libraries and Popular Education," etc., which are generally opened by some well-known educationist, besides lectures on well-known educational reformers like Arnold, Pestalozzi, etc., there are also illustrative lessons given by practical teachers to classes of children and young people, and after the lesson criticism and questions are invited. These lessons seem always helpful and suggestive, though I can hardly say as much for the criticism which follows. Any one present may criticise, and some of the criticism is distinctly beside the mark. Some part of it, at all events, seems made for the purpose, too common among critics, of exhibiting the wonderful cleverness of the speaker in seeing faults, where commoner minds see only virtues. Still, even the silliest and most feeble remarks are useful to the more humble-minded listeners, by drawing out the opinions of the lecturers, and leading them to explain more fully their methods of work. The lecturers who gave the lessons at Cambridge were most courteous and kindly, and seemed, indeed, actuated by the spirit of the one who said, on my remarking on the ineptitude of some of the speakers, "Ah! but if, out of *ten* criticisms, one gets *one* true one, it is a thing to be thankful for." That remark was a lesson in itself!

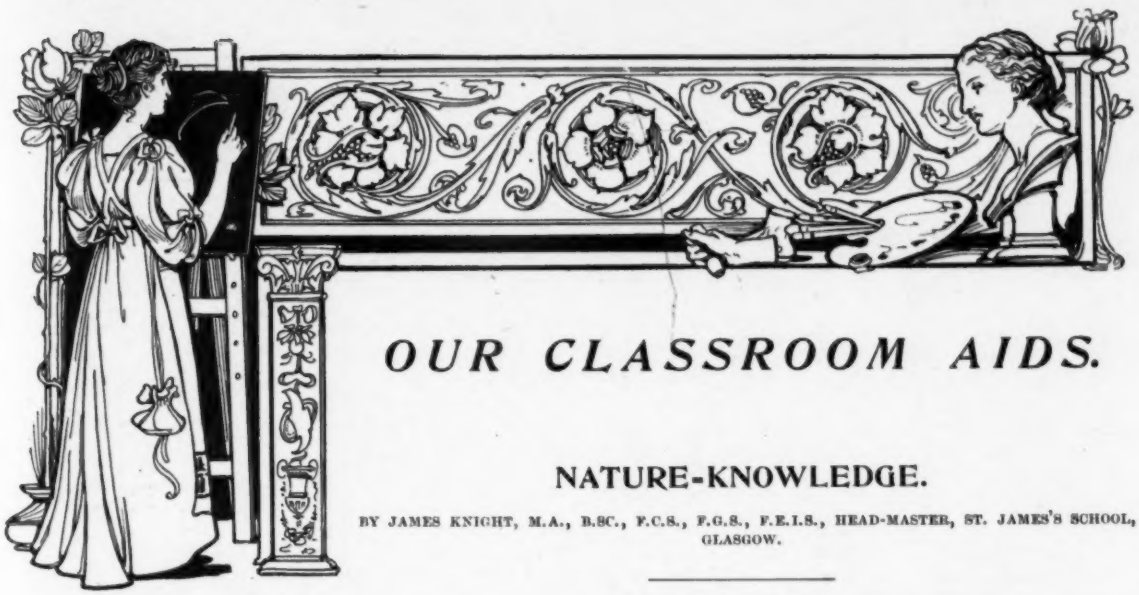
It must not be lost sight of either, that in spite of the diverse nature of the subjects for lectures, there is generally one central idea running through the whole, as that of "The History of Europe in the Nineteenth Century" at Cambridge this year, and "The History of Mediæval England and Mediæval Europe" (13th to 15th century inclusive) at Oxford next. A whole succession of lectures dealing with this central point is given, and every opportunity is afforded for students to master the subject thoroughly if they wish. In *The University Extension Journal* for January 1903 (price 3d.) a "Guide to Preparatory Reading" for the next summer meeting at Oxford is to be published, and those who read the books recommended, and then go through the course of lectures, will reap very great educational advantages. Books of reference, indeed, were provided on the spot by the Cambridge committee this year, and a nice, quiet room to read them in—everything, in fact, to make study pleasant and easy, except *time*, which was lamentably lacking. The heart of one eminent educationist, at least, would rejoice to hear that to *study* at the meeting is, for any one who goes thoroughly through the course, a practical impossibility. Study, however, can be done either before or after the meeting; and meanwhile the many social pleasures that the committees provide for us fill up the time between the lectures profitably and pleasantly. The fascination and beauty of a university town, the contact with fresh people and fresh ideas, the converse with the multitude of foreigners who frequent meetings such as this, and who are always ready and anxious to air their really excellent English, all conspire to make the most idle moments of our "playtime" *educational* in the truest sense.

I must not omit to mention that this year at Cambridge Nature Study was made a prominent feature of the meeting. Those who wished to enter on it from a scientific basis had an opportunity, by payment of an extra fee of 15s., to take up a course of work in which they not only had lectures, but demonstrations, and did practical work in the university laboratories, thus fulfilling in a slight degree the aim of the earliest students at these Cambridge Summer Meetings. As for the rest of us who tackled the subject, few of those who attended the nature-study lectures under Professor Patrick Geddes, and the illustrative lessons given by Miss Von Wyss, will fail to realise either the importance of the study, or be deficient in ideas as to the best way to set about it. Some of us, I feel sure, hardly realised, till we attended this meeting, how little we possessed the art of *seeing;* none of us, I think, can have gone through the course under these two enthusiastic teachers without feeling dimly that for us too it might, in a humble way, be possible to aspire with Charles Kingsley to

> "See in every hedgerow
> Marks of angels' feet;
> Epics in each pebble
> Underneath our feet."

When I say that the cost of an Extension Meeting ticket is reduced for teachers, and comes to not more than 30s. for the whole meeting, or £1 for either of the two parts, and add, furthermore, that the ticket admits not only to lectures but also to organ recitals, conversaziones, visits to colleges, etc., without further fee, I think many teachers will feel inclined to avail themselves of its undoubted benefits, particularly when it is remembered that most of the principal railway companies grant a return ticket, extending throughout the meeting, at the price of one fare and a quarter, to those who can show an "Extensionist's Summer Meeting ticket."

In conclusion, let me beg those teachers who have never been present at a meeting of this kind to come to Oxford next year, and see and hear for themselves. If they come once, I think there will be little doubt that they will come again; for though they may not be able to believe, as, according to *The Saturday Review*, most Extensionists do believe, that they have had extended to them the benefits of the "Literæ Humaniores," but will rather remember the lines of Elizabeth Barrett Browning about "sipping like a fly" at the great fountain of knowledge, yet the "sip" they take will be very good, and, like poor little Oliver Twist, they will ask for "more."



OUR CLASSROOM AIDS.

NATURE-KNOWLEDGE.

BY JAMES KNIGHT, M.A., B.SC., F.C.S., F.G.S., F.E.I.S., HEAD-MASTER, ST. JAMES'S SCHOOL, GLASGOW.

LEAVES (*Continued*).

REFERENCE has already been made (see January number) to the chemical work done by leaves, and several simple experiments were outlined in order to demonstrate plant nutrition to a class.

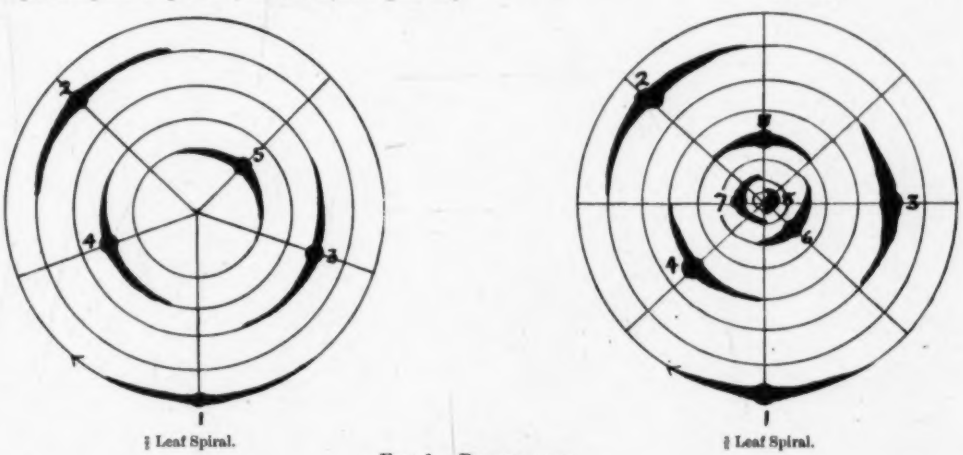
A stem has already been defined (February) as that part of a plant which bears leaves arranged in a certain definite geometrical order; and though the term "leaves" includes scale-leaves, seed-leaves or cotyledons, and floral leaves, the order in question is most easily traced with regard to ordinary foliage leaves.

There are two great methods of leaf arrangement, or phyllotaxis. In the first case the leaves are arranged in *whorls*, from two up to ten leaves being arranged round the stem like spokes of a wheel. This type is shown in the horsetails, the bedstraws, woodruff, and many others. Dead-nettles show an interesting variation on this. These plants have a square stem, and the leaves opposite, in pairs; but while the first pair lie, say, east and west, the pair above lie north and south, then the next pair east and west, like the first, and so on. The whole plant has thus a square formation, each face of the stem having insertions of leaf-stalks.

The second arrangement is a *spiral*—that is to say, the leaves do not spring from the stem at the same level, but follow each other up the stem or branch in regular order. What that order is depends upon the plant in question, but the object is generally to secure the greatest amount of air and light for each separate leaf. Take a branch of a beech tree and notice how the bottom leaf springs from the left side, say, the next leaf from the right, the third again from the left, in line with the first, but of course higher up, the fourth in line with the second, and so on. Passing a thread round the stem so as to touch the leaf insertions, we find that there are two leaves in every turn, or that the angle between each pair of successive leaves is half a turn, 180°. This arrangement is represented by the fraction $\frac{1}{2}$, which may be read either two leaves in one turn, or one-half of the circumference between each pair of leaves. Such a stem forms all its branches and shoots in one plane, right and left, and hence beech stems are much in request for pea-trainers.

Now take an apple branch and mark any low leaf-stalk with chalk, then run the finger straight up the branch to find another leaf inserted exactly above the first. This will be the sixth in order—that is to say, there are five leaves in the set, and a spiral thread has to be wound round the stem twice before it reaches the sixth leaf, which is opposite the first. The formula in this case is $\frac{2}{5}$—five leaves in two turns, or two-fifths of a turn between each leaf and the next. The commonest series of fractions obtained in this way is that well known in mathematics—$\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{8}$, $\frac{5}{13}$, $\frac{8}{21}$, etc. It will be seen that after the first two, the numerator and denominator of each fraction are obtained by adding those of the two preceding; or the whole series may be got by evaluating the continued fraction

$$\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{1+}}}\ \text{etc.}$$



⅖ Leaf Spiral. ⅜ Leaf Spiral.

FIG. 1.—PHYLLOTAXIS.

The spiral arrangement may be drawn as shown in Fig. 1, which represents the ⅖ and ⅜ styles.

Not only does this phyllotaxis serve to secure the maximum of light and air for each leaf, but the very irregularities of the

leaves themselves, as to shape and size, conduce to this result. On looking at a bed of ivy spreading over the ground, or at Veitch's creeper climbing up a wall, one cannot but see how

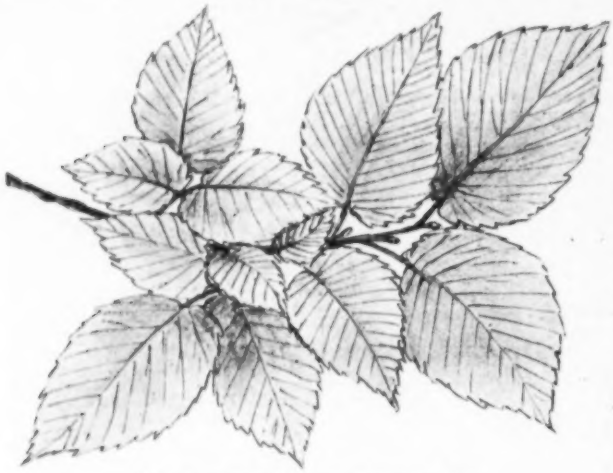


FIG. 2.—LEAF MOSAIC: SPRAY OF ELM.

every inch of space is utilised, so that no leaf is unduly "blanketed" by its neighbours. Such arrangements have been called leaf-mosaics, and many of these lend themselves to decorative imitation in the drawing class. The figure shows such a mosaic exhibited by the unsymmetrical leaves of a spray of elm. Such an economy of space is often assisted by unequal lengthening of the leaf-stalks, and also by twisting of the stem, so as to bring the leaf-blades into the horizontal plane.

Another point about the arrangement of foliage leaves on the stem is their relation to the water supply of the plant. Take any of the forest trees, say the spruce fir, and observe the conical aspect of the tree, and also the droop of the branches. Rain falling on such a tree is carried out from the centre to the ends of the top branches, from which it drips to the branch below, where it is carried still farther out, and so on, till it finally drips from the lowermost branches on to the ground, leaving a fairly wide circle of dry earth round the trunk. This may be called the centrifugal system of water-carriage, and of course the roots of such a tree must spread widely all around to reach the moist area. Now take any of the ferns, or such a plant as garden rhubarb. Here the whole arrangement is designed to produce the opposite effect. The leaves are broad and slope upwards; their stems are in many cases channelled so as to carry water down from the leaves to the centre; the leaf-stalks are often fringed with hairs, guarded by stipules, or provided in some other way so as to prevent escape of water at the sides; lastly, the root is tap or bulb shaped, and the moist area immediately surrounds it. These types of water supply are illustrated in Fig. 3.

The tints of leaves deserve to be noticed. Nearly all of them show shades of green, and in the case of horizontal aerial leaves the under surface is lighter than the upper, as already explained. Show that this green colouring matter, chlorophyll, may be washed out of a leaf by soaking it in spirits of wine, as described in the January number. Show also how light affects the colour of leaves, by growing some plants in the dark. Variegated elder, geraniums, begonias, the purple and copper beech, beet, and the white forms of aspidiatris may be mentioned as suitable for illustrating leaf-tints, and more especially the autumn leaves of the Virginia creeper and Veitch's creeper.

The varying odours of leaves, used as a means of protection or attraction, are due to volatile oils, and they may be shown by crushing such leaves as those of thyme, mint, scented geranium, and bog myrtle.

Modifications of leaves next fall to be considered. First come those auxiliaries known as stipules, developments of the leaf-base, which in grasses and monocotyledons generally appear as a leaf-sheath, enclosing the stem. Sometimes these stipules are intended to protect the young leaf in bud, and in that case they become brown and scaly, and are not permanent. Very often, however, they are green like the leaf-blade, and perform the functions of leaves.

Bracts are leaves, generally green, which subtend flowering shoots. They are generally single, and the floral axis springs from the angle which the bract makes with the stem. In compound flowers, like the daisy and dandelion, the bracts form a green cluster below the "head" of flowers, and beginners are very apt to mistake them for sepals, before the compound nature of the flower is recognised. Compound bracts of this kind form an involucel or involucre.

It will be sufficient to outline some of the more common modifications of leaves. First, the disappearance of prickles from holly leaves as they rise above the region of possible attack. Watch the narrow, erect, linear leaves of plants grown in crowded situations, say in a hedgerow, where light and air are scarce, and compare these with the fuller forms developed in, say, some cultivated form which receives more generous treatment. The ribbon-like leaves of submerged water-plants need mention, as well as the fact that they have both sides alike. Leaves are often swollen by conversion into storehouses for water or food: the kitchen garden will supply many examples. Peas show tendrils in which the end leaflet has dropped its leafy character. Begonia and certain ferns show roots and bulbs springing from the edges and ribs of leaves. Lastly, a very interesting study is opened up by the insectivorous plants, which generally catch and digest their prey by means of their leaves. The sundew and butterwort are easily got, and show two distinct methods of capture.

Buds are young leaves contained within their wrappings. They may be leaf-buds or flower-buds, depending on the nature of the leaves within. The points to be observed about buds are their position on the stem, terminal or axial, the folding of the leaves within, and their unfolding when the bud opens; lastly,

FIG. 3.—CENTRIFUGAL AND CENTRIPETAL WATER-SUPPLY.

the special means used to protect the leaves from damp, frost, insects, and other hostile influences. A horse-chestnut branch makes a very good object for a lesson on buds. They should be got at different stages to show the expansion of the leaves.

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

Slates *v.* Paper. There is a general tendency now towards the substitution of paper for slates in schools. Personally, I should not mind if the slate was abolished. The disadvantages of its use are as follows:—

1. The slate conveys infection. Often the children *clean* (?) them with saliva, and even when water is used dirty slate-rags are kept.
2. There is no permanent record of the work done by the scholars when slates are used.
3. Slates are easily broken.
4. There is always the nuisance caused by broken pencils.
5. There is too great a strain on the eyes.
6. Children acquire the habit of frequently rubbing out what they have written, which engenders a hesitating style.

Pictures by the Best Artists. The Americans give admirable artistic training to the children by means of cheap reproductions of the works of the best artists. In one school I know these pictures are fixed up in frames around the wall—a few each month. In June, a portrait of Millet and half a dozen of his pictures—for example, "The Sower," "Woman Churning," "The Man with the Hoe," "The Angelus," etc.—are hung. The headmaster gives a few lessons upon Millet and his work, and the elder children write essays upon the pictures.

In July perhaps Raphael will be similarly treated. You should have frames which will allow of you easily changing your pictures.

These pictures are gems of art. I have before me, as I write, two specimens—"Feeding the Hens" (Millet), and "The Soul's Awakening" (J. J. Sart).

The value of this training cannot be estimated by a foot-rule, but I firmly believe it has an incalculably good effect on the *morale* of a school, and makes for true education.

New Evening School Regulations. The 1902-3 Evening School Regulations issued from South Kensington contain a few points worthy of special notice here just now. I will give a brief summary of them. They may be seen *in extenso* in the official handbook.

1. Religious instruction may be given, but must appear in the time-table.
2. Grants may be refused on students who are reported to be unqualified from want of sufficient preliminary training.
3. At least 25 per cent. of the expenditure must be found locally. Generally speaking, all schools must charge fees.
4. Fixed salaries should be paid to the teachers.
5. Progressive courses of instruction for students attending in successive school years should be provided.
6. Application to be placed on list of recognised schools must be made to the Board before October 1.
7. The instruction must begin after 4 p.m., or on Saturdays after 1 p.m.

A course should provide for at least twenty hours' instruction.

8. Inspectors will visit and report upon—(*a*) The sufficiency, condition, and suitability of the premises; (*b*) the apparatus; (*c*) curriculum; (*d*) instruction; (*e*) teachers; (*f*) progress of students, which they may test in such manner as may be necessary.
9. The subjects are divided into the following groups:—(*a*) Literary and commercial; (*b*) art; (*c*) manual instruction; (*d*) mathematics and science; (*e*) home occupations and industries.

"Subjects other than those given in the different divisions may be approved, should the Board consider them to be of educational value and suited to the needs of the locality."

The School Life. Writing on this subject in a recent blue-book, Mr. Hitchens, H.M.I., says:—"Now children no longer hate school. Football clubs are springing up, and matches take place between schools, and no doubt boys are learning to be loyal to one another, and to feel a pride in the good name of their school. The schoolmaster is not yet a leader in the playground or cricket-field—his past life has not made him one; but the young teachers from the training colleges show interest in games, and would associate with and lead their boys were there sufficient space provided."

In secondary schools the teachers generally mix with the scholars in the playground. I have found great difficulty in persuading teachers to join the children in their play. Wherever this is done, there is to be noticed less friction between teacher and taught, and more homely conditions prevail. It is such circumstances which lay a sound foundation for a healthy *esprit de corps*.

Discipline in Schools. In the General Reports just issued there are some interesting remarks upon this subject. Mr. King, H.M. Senior Chief Inspector, gives us a valuable explanation of the passage in the revised instructions. I will quote a few lines: "If the scholars were always obedient and attentive, punishment would be unnecessary; if the vigilance of the teacher were always alert, the tendency to misconduct would be checked before it had become active. Secondly, any punishment that is frequently repeated is proved thereby to be ineffective. Further, no punishment should be allowed that is cruel, and this rule applies, perhaps, more to punishments which are sometimes recommended as substitutes for the moderate chastisement that is occasionally necessary. Timely warnings, such as those contained in the 'Instructions,' are like the sword of the magistrate for the few evildoers, not for the great multitude whose conduct in these matters deserves commendation, not censure."

Mr. Greene quotes from *Old Mortality*—"There is one individual who partakes of the relief afforded by the moment of dismission, whose feelings are not so obvious to the eye of the spectator, or so apt to receive his sympathy. I mean the teacher himself, who, stunned with the hum, and suffocated with the closeness of his schoolroom, has spent the whole day (himself against a host) in controlling petulance, exciting indifference to action, striving to enlighten stupidity, and labouring to soften obstinacy; and whose very powers of intellect have been confounded by hearing the same dull lesson repeated a hundred times by rote, and only varied by the various blunders of the reciters"—and says a similar state of things existed in some places twenty years ago.

These were the good old days with a vengeance.

THE "NOTEBOOK" QUERY COLUMN.

Letters intended for this column should be addressed "Inspector," care of Editor, PRACTICAL TEACHER. Only in very urgent cases can replies be sent by post, and then only when two stamps accompany the letter.

T. desires information respecting the age limit and other matters for the London Matriculation Examination.

He is advised to write for a syllabus to the Registrar, London University.

Candidates must be at least sixteen years of age before the commencement of the examination.

A. A. is an untrained teacher who passed in the second division, but desires to be trained, as she finds she is handicapped in applying for good posts.

Answer.—I do not know your age, but should, on the whole, advise you not to bother about entering a college for one year. You can easily get in if you so wish; but if you graduate at St. Andrews, that should compensate for the loss of training. Then a Teaching Diploma on the top would quite set you up.

By all means complete the L.L.A. without delay. If you care to consult me again, I shall be pleased to give you further advice.

Epidemic.—You must be prepared to satisfy the inspector that the scholars marked (E) on the registers have been suffering from an infectious disease. The medical officer of health should be consulted as to what complaints may reasonably be included under this head. A liberal interpretation will usually be given.

M. B.—I will deal with the matter next month.

A COURSE OF OBJECT LESSONS FOR GIRLS' SCHOOLS.

BY WILLIAM DONE, B.A., HEAD-MASTER OF BRIGHTON PUPIL TEACHERS' SCHOOL.

XXXI. THE WEATHER.

Articles of Illustration.—Weather-charts enlarged on the blackboard; thermometer; barometer; bunch of dried seaweed; pieces of thick string and of catgut; a toy weather-box; illustrations of cloud forms; a tin can.

Observation and Experiment.	Result, Inference, and Teaching.
I. Record of Weather. For a week previous to the lesson take records of the direction of the wind, the temperature of the air, height of barometer, and the fineness or otherwise of the day. Such records should be registered at noon, just before the girls leave school. A few questions at the same time should be put, so as to recall to the children's minds the conclusions arrived at in Lessons XIV., XV., XVI., XVII. on Pressure of the Air, Barometer, Heat and Temperature, and Thermometer.	Though the records have been taken at the same time each day, considerable variations have been found in the warmth of the air, the direction and strength of the wind, the fineness of the day, and, in fact, in all those items which make up what we call the weather.
II. The Wind. Place on the blackboard the records of the direction of the wind on each day of observation, and whether the wind was light or strong. Give various terms applied to winds in order of velocity—calm, gentle breeze, fresh breeze, gale, storm, hurricane. Show on the weather-chart how arrows are generally used to point out the direction and to indicate the velocity of wind. Give approximate velocity in two or three typical cases—calm, 3 miles an hour; strong gale, 40 miles; and hurricane, 90 miles an hour. (Scott's *Meteorology.*)	The different terms applied to the wind help us to form some idea of its varying strength, since the faster it travels the stronger it blows. We can now understand how it is that a hurricane can do so much damage, even to uprooting trees, seeing that it rushes along at twice the speed of an express train. The arrows indicate by their different shapes the varying strength of the wind, as well as its direction. We should expect a falling barometer to precede an inrush of air.
Point out the isobars on a weather-chart enlarged on the blackboard. One of the charts of the Meteorological Office is most useful, especially if showing the progress of a gale. State how the curves are obtained—by means of telegraphic reports from various stations of observation.	These lines show us the varying pressure of the air registered by the barometer over a great part of Europe. We see where the barometer is falling and where it is rising, and consequently where to expect bad weather and where fine weather. We notice the curves registering differences of one-tenth of an inch pressure are in some cases closer together than in others, indicating a stronger inrush of air. Winds all partake more or less of the nature of circular eddies in the atmosphere, similar to the circular eddies of dust we sometimes see. [Teacher to confirm and to give name *cyclonic.*]
Refer to prevailing winds at different seasons of the year in England. On the whole, however, we live in a region of variable winds.	In the winter we sometimes get many north-east winds; in the spring the general direction is more to the east. Such winds are cold and dry, as might be expected from the direction whence they blow. In the summer we expect winds from the west, south-west, and south-east. Such winds are mild as a rule, and the westerly winds bring us moisture from the Atlantic. But, as we have found out by our records, there is no dependence to be placed on these directions. We live in a country of variable winds.
III. The Rain. The principal items in the weather to children are rain and sunshine. Question as to the expectancy of rain and sunshine at different seasons of the year.	We have, as a rule, most rainy days in winter. We also expect showers in April. June is sometimes a wet month; while we generally look forward to having a bright, sunny August. The barometer, or weather-glass, is again a help to us here, since the mercury falling precedes wet as well as wind.
Show pictures of various kinds of clouds. Three chief kinds—"*heaps*," "*beds*," and "*feathers*." Refer to sunset appearances—abnormal clearness of atmosphere at times, and what these varying appearances indicate.	A feathery or mackerel sky is often seen just before a change of weather sets in. In the morning and evening the clouds mostly lie in great layers or beds. A red sky at sunset usually precedes a fine day. In summer we often see great clouds heaped in fanciful shapes; sometimes similar black storm clouds; while in steady, continuous rain the sky is generally quite overcast with a heavy leaden-coloured pall of cloud. If we see things at a distance much clearer than usual, we expect rain.
Measure a piece of thick dry cord stretched tightly; wet the cord thoroughly and measure it again. A similar experiment with a piece of catgut.	Wet causes the cord to shrink. Mother's clothes-lines are tighter after getting thoroughly wet. Catgut becomes longer when wetted.
Show a weather-box in which one may ascertain changes in the weather by the appearance or disappearance of figures, such as a man and a woman. Call attention to the catgut at the back of the box, and how the position of the figures depends upon the twist of the catgut.	As the catgut gets damp, and so becomes longer, the twist is not so tight, and causes the figure of the man to move forward. Dry weather will produce an opposite effect.
Refer to the absorption of moisture by salt, by dried seaweed, etc.	The great drawback to such a method is that it is only useful in somewhat long periods of wet or fine, since the catgut takes some time to change its condition. Salt, dried seaweed, etc., tend to become damp in wet weather if exposed to the air.
Read that part of a weather report which refers to rainfall. "The weather was dull and rainy in many places. The amount of rainfall reported at Brixton since 8 a.m. was ·66 inch, making a total for twenty-four hours of 1·14 inches."	To find out the quantity of rain which falls in a certain place during a certain time, the rain must be collected, and not allowed to sink into the earth. We need not take a very large area—a square foot, or even a smaller space of ground, might be taken as a sample.
Show how to roughly determine the area of the bottom of a tin can, or a similar article, by covering it with square	Such a can exposed freely to the air could catch what rain would fall on the space covered by the bottom. The height of

Observation and Experiment.	Result, Inference, and Teaching.
inches of paper and cut-up portions of square inches. *IV. The Temperature of the Air.* Recapitulate the various items dealt with in regard to the weather, and elicit that we have left out two very important items—warm and cold weather. Read the temperatures of the air taken during the previous week. Refer to the diagram on the blackboard, and show how variations of temperature may conveniently be represented by a line.	the water collected would need to be very carefully measured. The seasons of the year must, of course, largely determine warmer and colder weather; but we all know there are considerable differences, even daily, owing chiefly to the direction of the wind, as we saw in the early part of the lesson. Though our skin is a good judge of heat and cold, the thermometer is a better measurer of the difference in degree. If we combine all these items on a weather-chart, we can see at a glance exactly what the weather has been like.

Conclusion.—Read the whole weather report occurring in a daily paper, the text of which corresponds to the diagram on the blackboard.

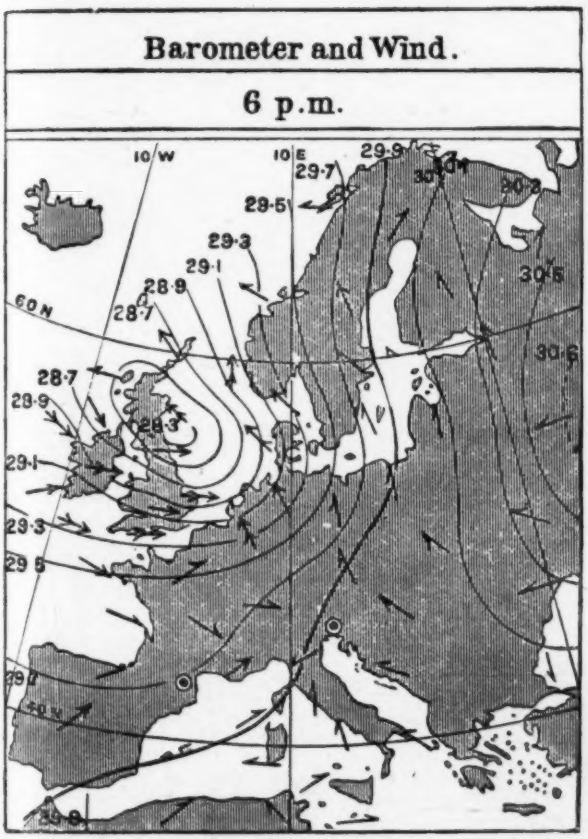
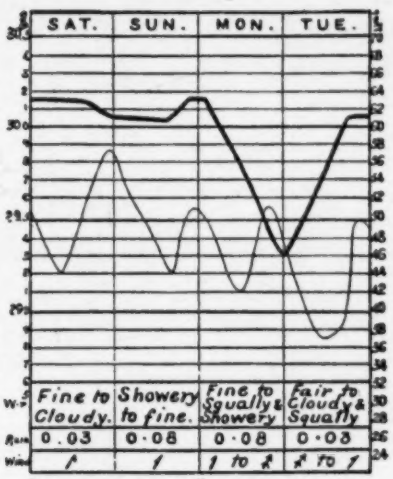


DIAGRAM TO ILLUSTRATE THE GALE OF NOVEMBER 11, 1891.
(By permission of the Meteorological Office.)

The barometer is expressed by isobars. The winds are shown by arrows.

⊙ = a calm; → = a light or moderate wind; → = a fresh or strong breeze; ↠ = a gale.



"DAILY CHRONICLE" WEATHER CHART, DECEMBER 8, 1891.

Explanation.

The thick line shows the variation in the height of the barometer during the past four days. The thin line shows the shade temperature for the same interval, and also the maximum and minimum readings for the day.

Remarks.

8.30 P.M.

The depression which was advancing from the Atlantic to our south-west coasts on Tuesday has proved to be of great depth, and has caused gales over all parts of our islands, from between south and west in the Channel and the south of England, from south-west and south-east over the east of Great Britain, from the eastward in the north, and from north-west in the western parts of the kingdom. Over the Channel the gale has been of great severity. At eight o'clock this morning the centre of the system lay over Wales, and during the day it has continued its north-easterly course across the northern parts of England. The disturbance was accompanied by heavy falls of rain generally, the amounts measured at many of our southern and south-western stations exceeding an inch. At 6 p.m. to-day pressure was highest, about 29·8 in., both over the Gulf of Bothnia and the Spanish Peninsula; lowest, about 28·3 in., a little to the east of the Firth of Forth. The barometer was falling quickly in the north and north-east, rising in the west and south, rapidly over the south of England. Gradients were still steep, especially over England and the North Sea. Temperature was highest, 49 deg., at Brest, Jersey, and Aberdeen; lowest, 41 deg. to 44 deg., over Ireland, 43 deg. in the Shetlands, 44 deg. at Shields and in London, and 45 deg. at York and Yarmouth. Wind was blowing a fresh to whole gale from west or west-north-west over England, and a strong south-easterly gale over the north and east of Scotland, Denmark, and the south of Norway. At Valentia Island it had backed somewhat since 2 p.m. Weather was dull and rainy in nearly all places, with squalls of hail at some of the Irish stations. In London and at Hurst Castle, however, the rain had ceased, and the sky was clearing. The amount of rainfall reported at Brixton since 8 a.m. was 0·66 in., making a total fall of 1·14 in. during the past twenty-four hours. Sea was exceedingly high at Aberdeen, and high or rough on all parts of our coasts. The disturbance will probably continue to move away north-eastwards, and the gales over our islands will gradually subside with improving weather.

Every Practical Teacher should be a Subscriber to
THE PRACTICAL TEACHER'S ART MONTHLY.
Price Threepence.

The Practical Infant-School Teacher.

OUR MODEL INFANTS' SCHOOLS.

XI.—FINSTALL BOARD SCHOOL, STOKE PRIOR, U.D., WORCESTERSHIRE.

Head-Mistress.—MRS. C. H. TUNBRIDGE.

TO persuade a mistress of a so-called rural school to submit to an interview for publication is well-nigh a herculean task. The work is so quietly done, and the routine is so much the same from day to day, that she thinks she gets "out of date" and "behind the times" without being able to alter the matter. The consequence is she forgets that originality and development are quite as likely to be found in a secluded and sequestered spot as in a densely-populated district. For ourselves, we are sure that there are equally efficient and painstaking teachers in the small schools as in the large ones; and it ought to be a good thing for the town mistress to be able to compare methods of organisation and the scope of instruction as practised by the country teacher. This is our reason for selecting a well-known, excellent school, in a district some distance from any large town, as our eleventh MODEL INFANTS' SCHOOL.

Twenty-one Years Ago

Finstall could not boast of a school. The whole parish consisted of nine hundred and ninety people. These were

"AN INTERESTING CORNER."

a few aristocrats, who dwelt in mansions surrounded by spacious parks, and dwellers in cottages. The children of the cottagers had to walk at least two miles to reach the nearest public school. Thanks chiefly to the Midland Railway Company, whose main line, from Bristol to Birmingham, runs right through the village, the district has grown by leaps and bounds. The Bromsgrove Railway Station is in the very heart of it. The population of the parish now numbers some three thousand people.

The Board school was built in 1882 in a quiet spot on the Redditch and Stoke highroad, about two minutes' walk from the station. Then there was hardly a house near; now the school is surrounded by them on all sides but one, and on this there are allotments where spade cultivation and diligent evening work produce kidney-beans and other culinary vegetables which are at once the glory of many a market stall, and the admiration of all whose good fortune it is to purchase them. At the time of opening, the needs were comparatively small, but latterly the accommodation has had to be increased. There are now places for about five hundred children, of which one hundred and fifty are in the infants' department. Mr. and Mrs. Tunbridge were appointed first master and mistress. There was thus opened out to them a grand opportunity of co-ordinating the instruction in the two departments to the best advantage of both. This they promptly seized. The first thing they set their minds upon was the

Punctual and Regular Attendance

of the children. It was uphill work, as all teachers who have opened schools in neglected neighbourhoods know. They plodded on, trying first one means and then another, succeeding bit by bit, till at the present time if the attendance does not reach and sometimes exceed ninety-five per cent. they are utterly astonished. By their united efforts the School Board is seldom, if at all, troubled with bad attendance cases. Hardly ever does a child stay away from school with a trivial excuse. It is true that the School Board is generous enough to award prizes for regular attendance, but the high standard of excellence is due to the devotion and influence of the teachers. The latest method employed to secure regular attendance is the ticket system. A neatly-printed ticket is given on Friday afternoons to the children who have been "Never absent, never late," during the week. This ticket is expected in the homes, and the parents have grown into the habit of looking at it in the light of an attendance receipt. At the present moment there are children in the infants' department who have not missed an attendance for three years, and in the upper school there is a girl—Mildred Adams—who has not lost a single attendance since she was admitted to the school ten years ago. It is worthy of remark that during the twenty years the school has been opened there have been but three prosecutions.

As might naturally be expected under such conditions, the work of the children is of a very high order. The

Elementary Instruction

would compare favourably with any school in the country, and H.M.I. (Mr. M. J. Barrington-Ward) is very proud of it, and does not fail to say so in his annual reports. The breaks in the instruction are necessarily few, and the effect

of the continuity is clearly seen. The reading is beautifully fluent, and the expression perfect. The children stand in an erect posture, and hold their books just as if they are looking into a glass where all kinds of magnificent things are to be seen. The writing (M'Dougall's Upright System) is uniformly good throughout the school, and the work of one child can hardly be distinguished from that of another. The children in the highest class (aged six) write, and do all such work, on paper with lead pencils. The mental and written arithmetic are both excellent. In all kinds of paper work the children of village schools have a distinct advantage over those who dwell in towns. It cannot, of course, be denied that village children play with puddles, and sand, and such like. They have little else to amuse themselves with, unless it be gnawing turnips and robbing birds' nests in the season. But their fingers are clean notwithstanding, and their papers at school are not disfigured by dirt. The writer had the privilege of listening to two lessons in arithmetic — to babies and the children aged five. In the former case it was like a game; in fact, the lesson was called

"Bran-pie Lesson."

A large box was partly filled with bran, and amongst the bran there had previously been mixed a number of packets containing up to five sweets or biscuits. The children marched past the box, and each took a packet. When all had been "served," and places were resumed, the packets were opened by the children as the teacher desired, and the contents used as counters. The sweets or biscuits, as the case might be, were sorted into twos and threes and fours, and additions and subtractions were made with them. Occasionally questions were put to the children on the colours of the sweets, and exercises such as, "Two pink sweets and three brown sweets make five sweets;" "One yellow sweet from four yellow sweets leaves three;" and so on. A further step was as follows. Two packets were put together and counted. "Twice five are ten," was the result. In the lesson to the five-year-olds, an abacus containing ten coloured balls on a straight piece of wire was given to each child, while a larger one was used by the teacher in view of them all. The children were thus enabled to do their own counting on their own abacus. This is certainly an advantage over the method of counting from the apparatus in front of the class; for it is when little children *do* things for themselves that they learn most, and the instruction is most lasting. The idea is Mrs. Tunbridge's own, and similar miniature abacuses can now be obtained from Mr. Thomas Evans of Redditch. Cubes with numbers on their faces are also used.

Kindergarten

is a strong feature of the school. The babies work with beads. Here again the beads are of various colours. They thread them according to instruction (in twos, etc.) on very fine wire, and make pretty and fantastic shapes with them. The wire is as fine as the finest cotton, and yet it does not break; and its flexibility enables the children to make rings, leaf and flower forms, etc., with them. The five-year-olds do pricking and embroidery, while the work of the older children is really very elaborate and magnificent. We will mention three sorts of work as examples, though several others are to be seen: (1) Embossing; (2) mat-weaving; (3) sampler-work. The boys of the upper department do the drawings for the little ones, who then colour them and emboss them. Smyrna wool rugs are made, as well as other pretty and useful articles for the home. The sampler-work is the best and most effective of all. "God bless our Home," "The Bread of Life" (see illustration) are among the sentences worked. The perforated cardboard is purchased from a fancy dealer's shop. They are stamped in such a way as to enable them to be worked with silk pretty easily when care is taken. These useful articles are sold to the parents

KINDERGARTEN (UPPER DIVISION).

at the end of the school year, and by this means the kindergarten materials cost but little, if anything. The

Needlework,

too, is very elaborate, and particularly well done. In addition to the sewing generally found in infants' schools, shawls and woollen scarfs are among the articles shown under this heading.

Recitation

with actions was very pleasing, and the expression and clear utterence were as marked as in the reading exercises. *Little Poems for Little People*, by Edward Shirley (Thomas Nelson and Sons), are acknowledged to be among the easiest and brightest that can be procured. They afford splendid and suitable exercises for the infant folk.

Marching and Singing

are to the accompaniment of the piano. One of the many song-books in use is Nelson's *Infant School Song-book*, "Medley of Rhymes." Song No. 4 of Book II., in which "Tom, Tom, the Piper's Son," "Little Jack Horner," "Sing a Song of Sixpence," and "Three Blind Mice" are quaintly mixed up, was very amusing, and thoroughly enjoyed by the children, who seemed quite at home with the "points" of the song. "Jingle Bells," a song of Book I., was also rendered in a most pleasing and effective way.

Object Teaching

is another strong point of the school. It will be seen from the approved scheme, which is appended, that the subjects for each class are subdivided, and the time-table shows an arrangement for their study at stated times. The museums are well filled with useful specimens, and in addition there are several special cases of manufacturers' goods. The subjects, which are treated in a very simple and elementary way, are well within the range of the children. The lessons on nature phenomena, geography, and miscellaneous subjects

TIME-TABLE—INFANTS' DEPARTMENT, FINSTALL BOARD SCHOOL.

MORNING.							*AFTERNOON.*						
Cl.	10 to 10.30.	10.30 to 10.45.	10.45 to 11.	11 to 11.30.	11.30 to 12.	Day.	2.15 to 2.30.	2.30 to 3.	3 to 3.25.	3.25 to 3.35.	3.35 to 3.55.	3.55 to 4.5.	4.5 to 4.15.
I.	Arithmetic.	Colour.	RECREATION.	Reading.	Writing.	MONDAY.	REPETITION OF POETRY OR TABLES.	Girls—Needlework. Boys—Drawing. Games. Kindergarten.		RECREATION.	Natural History.	Word Building.	MARCHING AND DISMISSAL.
II.	"	Form.		Writing.	Reading.						"	"	
III.	Mental & Figures.	Colour.		"	"						"	"	
IV.	"	Form.		Reading.	Writing.						"	"	
I.	Same as Monday.	Weak Subj.		Reading.	Writing.	TUESDAY.		Reading. Kindergarten.	Kindergarten. Reading.		Geography. Object Teach.	Word Building.	
II.		"		Writing.	Reading.						"	"	
III.		"		"	"			"	"		"	"	
IV.		"		Reading.	Writing.			Reading.	Kindergarten.		"	"	
I.	Same as Monday.	Form.		Reading.	Writing.	WEDNESDAY.		Same as Monday.			Miscellaneous. Nature Phenom. Miscellaneous.	Word Building.	
II.		Colour.		Writing.	Reading.							"	
III.		Form.		"	"							"	
IV.		Colour.		Reading.	Writing.						"	"	
I.	Same as Monday.	Trades.		Reading.	Writing.	THURSDAY.		Reading. Kindergarten.	Kindergarten. Reading.		Object Teach. Trades.	Word Building.	
II.		Moral Instr.		Writing.	Reading.						"	"	
III.		"		"	"			"	"		"	"	
IV.		"		Reading.	Writing.			Reading.	Kindergarten.		"	"	
I.	Same as Monday.	Weak Subj.		Reading.	Writing.	FRIDAY.		Same as Monday.			Singing.	Word Building.	
II.		"		Writing.	Reading.						"	"	
III.		"		"	"						"	"	
IV.		"		Reading.	Writing.						"	"	

NOTES.—1. The head-mistress superintends the teaching of Classes I. and II., ages 6 and 5 respectively. She is assisted by a pupil teacher, third year, and a probationer.
2. The assistant-mistress has charge of Class V., age 5.
3. A pupil teacher and a monitor have charge of the babies, Class IV., ages 4 and 3. This class is worked in two divisions.
4. Story-telling may be taken on Friday afternoons instead of singing.
5. Registers are closed at 10 a.m. and at 2.15 p.m.
6. Prayers, hymn, and Scripture, 9 to 9.45.

Approved and signed on behalf of the Education Department by
M. J. BARRINGTON-WARD, M.A., H.M.I.

are really conversational lessons under other names. They lead up to the lessons in geography of the upper school. The children, led and directed by the teacher, describe what they have seen. The reason *why* such and such a thing is is supplied in a homely and simple way by the teacher conducting the lesson. Such teaching puts one very much in mind of family gatherings and fireside chats, from which a great deal of useful information can be gathered. These "leading-up" subjects are found to be of distinct service to the little ones when they cross the yard, and are transferred to the department where their elder brothers and sisters are taught. The infants are glad to be learning the same kind of things as their elders, and they have been known to talk them over in their play and in their homes. No sooner has a new lesson been given than it is rehearsed in the roads. If a child happens to have been absent from school (and from

"IN TOKEN OF LOVE AND ESTEEM."

the remarks that have been made on the splendid attendance this will be seen to be a rare occurrence), he is pretty quickly *hors de combat* when a question is proposed to him. Young though he be he feels the disgrace, and heartily wishes he had been there when teacher spoke of such wonderful things. Perhaps this is one of the aids to regular attendance.

The lesson the writer had the privilege of listening to on the day of visitation was "The Tiger." No lesson could have been more simple and more suited to the children than this. They had never met a tiger in the road, nor had they ever seen one roaming about among the sheep and cows in the fields. They had not even heard him roar in the woods when they had been gathering primroses and ferns. They had never known of his trampling down the daisies and the daffodils; but they knew there was such an animal. A picture was before them, one which showed the tiger's teeth. His claws were deeply imbedded in the tender flesh of the deer which had gone down to the silver brook for its evening draught. Their brothers, too, had talked of the tiger, and had even tried—naughty boys—to frighten them by saying one was coming for them. The teacher had procured a stuffed specimen of a fine old Tom, striped after the manner of the tiger. This and the picture drew from the children what they knew, and to fill the gaps the teacher added to their store. The form of body, the feet, the head, eyes, ears, and teeth were all compared with Tom's. The stealthy habits were talked about, and at the end the story was told of the gentleman in India who had kept a tiger from its birth till its ferocious instincts began to show themselves, and it had to be destroyed.

Object-Teaching Scheme.

Class I.

Natural History.—The stork, the bee, the goat, the giraffe, the swan, the shark.
Common Objects.—Tea, the daisy, iron, a watch, the breakfast-table, sugar.
Geography.—Plains and table-lands, a mountain, a river, the sea, lakes and islands, the cardinal points.
Trades.—The nurse, the fireman, the errand-boy, the milkman, the railway porter, the sailor.
Miscellaneous.—A ship, a lighthouse, a lifeboat, a farmyard, a railway station, a hayfield.

Class II.

Natural History.—The whale, the squirrel, the ostrich, the elephant, the horse, the eagle.
Common Objects.—Coffee, a letter, milk, the clock-face, a knife, sugar.

Nature Phenomena.—Spring, summer, autumn, winter, a mountain, a river.
Trades.—The postman, the policeman, the carpenter, the sailor, the gardener, the lamplighter.
Moral Instruction.—Kindness to animals, bird-nesting, dangers of playing with fire, throwing stones, the kind child, gratitude (illustrated by the story of the lion and the grateful little mouse).

Class III.

Natural History.—The cat, the cow, the donkey, the tiger, the duck, the sheep.
Object Teaching.—A railway train, a penknife, a bed, milk, a ship, a sponge.
Trades.—The baker, the postman, the gardener, the butcher, the sailor, the policeman.
Miscellaneous.—Winter, summer, laying a table, dolls, Christmas time, the farmyard.
Moral Instruction.—Throwing stones, playing with fire, little pilferers, helping mother, bird-nesting, the kind child.

Personal.

Mrs. Tunbridge will blush when she sees this paragraph in print. She is of a quiet disposition, and seeks no praise. The unadulterated truth, however, must be told. Having lived so long in the district, and having done such effective work in so many homes, it is not to be wondered at that Mrs. Tunbridge is idolised by parents and children alike. Her home is in the midst of her people, and here she may be found ready and willing at all times to help by advice and generous acts all who need her assistance. She is bound heart and soul to her present and former scholars, and is often appealed to by them. Some have now little children of their own in the school, while the girls in the upper department still look on her as their mistress. She superintends their needlework, and in many ways shows her anxiety for their present and future success in life. Her two daughters have grown old enough to join her staff as pupil teachers, and as they are clever and industrious in their work, they bid fair to become wise and clever mistresses. It is indeed a magnificent thing to see a whole family spending and being spent in the needs of the people among whom they dwell. During the recent Coronation Week both Mr. and Mrs. Tunbridge were recipients of a token of love and esteem, which was subscribed for by nearly every person in the parish. They have the best wishes of all, and we ourselves join in hoping that prosperity and happiness may attend them all their days.

NOTES AND JOTTINGS.

Messrs. E. J. Arnold and Son, Ltd., school outfitters, Leeds, inform us that they have purchased from Lewis Hardy, Esq., receiver for the debenture holders, the copyrights, publications, miscellaneous and general stock held by Messrs. Moffatt and Paige, Ltd., of 28 Warwick Lane, London, E.C., and that any inquiries for Messrs. Moffatt and Paige's stock should be addressed to them. They further state that they have arranged with the receiver for orders and inquiries sent to Warwick Lane to be forwarded to Leeds.

Scotch Education Department.—The examinations for Leaving Certificates and Intermediate Certificates, conducted in the month of June by the Scotch Education Department, have now been completed. Candidates were presented from 190 higher class and state-aided schools, and 364 Leaving Certificates and 605 Intermediate Certificates have been awarded as the result of these examinations. It is expected that the actual certificates will be issued in the course of next month.

The series of articles on "Ignition Devices for Automobiles," by S. R. Bottone, which have been running through the pages of *The English Mechanic*, will shortly be published in book form by Mr. Guilbert Pitman, with the addition of an introductory chapter treating specially on structural details, choice, and management of the motor car. Mr. Pitman will also immediately publish in one volume the "Amateur Electrician's Workshop," recently contributed serially to *The Young Engineer* by the same author.

Colonel C. G. Kitson, C.M.G., has been appointed to succeed Sir Edwin Markham, K.C.B., as Governor and Commandant of Sandhurst College.

General Markham is the oldest soldier in the British Army, as he entered on his military career in 1850, eighteen months before Lord Roberts joined the army, and has seen a great deal of active service.

Owing to want of accommodation and to the difficulty that would arise over the entrance examination, the War Office has decided to admit only the usual number of cadets—namely, 180; but with the January term steps will be taken to increase the number considerably. It is probable that the majority, if not the whole, of the junior cadets who were rusticated last term in connection with the outbreaks of fire will rejoin next term as seniors.

It is interesting to find the Trades Union Congress keenly discussing the Education Bill. In moving a long resolution on the subject, Mr. W. A. Appleton described it as perhaps the most important item on the agenda paper. The speakers, who had evidently bestowed much thought on the question, were practically unanimous in condemning the Bill. They set out the demands of the working classes for popular control over the schools, abolition of the fifteen-year limit, free evening continuation, higher grade, and technical schools, scholarships for higher education, increase of training college accommodation without sectarian bias or control.

A great International Exhibition is to be held at St. Louis in 1904, and the British Government has already accepted the invitation of the Government of the United States to take part in it. The exhibits to be made by the British Government in its official capacity will be limited to education in its different branches and the fine arts. The arrangements for the educational section will be under the direction of Mr. Sadler, director of special inquiries, and the fine art section will be under the direction of Sir Edward Poynter and a committee of the Royal Academy. The exhibition promises to be a vast undertaking, as an area of over two square miles has been set aside for the purpose.

The Report for 1902 on Secondary Education in Scotland has just been issued, and gives a very interesting account of the work going on. In dealing with the efforts made to secure good pronunciation in modern languages, the report says: "It is, however, still plain that many teachers do not yet fully realise how extremely important this side of modern language study is from the educational no less than from the practical point of view." The report includes a special report on the "Present Condition of Modern Language Study in Scotland," which we recommend to the notice of our readers. It points out the error of drawing analogies from classical studies, and insists on the adoption of the newer methods. "The really essential point is to begin at the beginning, and let the 'direct' method have the freest possible play from the earliest stage." And again: "The value of phonetics as an aid in teaching pronunciation is very inadequately recognised. I do not wish to see this imposed as an additional burden on the children; but I do feel that, if at all possible, every teacher of modern languages ought to have some acquaintance with the subject."

The inspectors continue to lament that the pupils are withdrawn at an age too early to benefit fully by the liberal provision often made for continuing their education. At the same time, an improvement has been manifest in the matter of regularity of attendance.

Many of our readers who practise photography know from experience the great advantage of having rolls of film with which they can load their cameras in broad daylight. The Kodak Company has now gone a step further, and introduced a developing machine, by the help of which it is possible to *develop* the films in broad daylight, and thus do away with the necessity of a dark-room from start to finish. The machine is a nickel-plated box in which the exposed spool is placed. A few turns of the handle unwinds the black paper covering of the film; the developer is now poured in, and the turning of the handle is continued until the negatives are developed. Fixing and washing are carried out in the same simple manner, and the process yields fine results with great certainty. Teachers interested in photography who have not yet visited the Kodak Exhibition, at 40 Strand, should do so at their earliest opportunity. It is open daily from 9.30 a.m. to 6 p.m.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SCHOLARSHIP EXAMINATION, 1902.
Tenth Month—October.

Work for the Month.

1. *Reading.—The Master of Ballantrae,* chaps. ix. to xii.

2. *Repetition.*—Plenty of oral practice.

3. *Teaching.*—The teaching of object lessons and varied occupations, chap. xi., *Scholarship School Management.*

All students should go very carefully through the Circular issued by the Department, and embodied in the Instructions to Inspectors, on this subject. The chief points to which particular attention should be given are:—

(1.) What is the use and object of such lessons? What faculties do they appeal to? A little consideration will show that there is no other lesson in the school curriculum which provides the teacher with more scope to develop all round the minds of the children in his class. Observation, classification, reasoning, memory, the development of a love for nature—animal and vegetable—the raising of the moral sense, etc., all may be cultivated in such lessons. It is going to the thing itself for knowledge, and not merely reading something about it, and thus getting a second-hand acquaintance with facts.

(2.) How should the lesson be given? How can the children be made to co-operate, and thus arouse a healthy interest and enthusiasm? This is fully answered in the Circular, to which students are referred.

(3.) What lessons should be given? The wise teacher will prepare his lists of lessons with an eye to local needs: what would be excellent for a country school would not be at all suitable for a town school, and *vice versâ*. There is an illimitable choice of things around each child of which he knows practically nothing, because his mind has never been trained to observe carefully and accurately. They have eyes, and see not. Such objects should be chosen as a child can investigate still further in his leisure moments. It is not so much what is taught in the lessons at school, as the increase of desire to know, that is of first importance.

4. *Drawing.*—A freehand copy per week, done under examination conditions. The examples submitted this month show some improvement as far as size and proportion are concerned, but there are still many whose idea of lining-in is a hard, wiry fine line instead of a smooth sweeping line. Another point should be attended to. It is well to vary the strength of the lines in a copy. The main curves and outlines should be bolder than the details; and where veins of leaves occur, they should follow nature and taper from base to point. Attention to this will give far more life to a copy.

5. *Music.*—Chap. x., *School Music Teacher.* This chapter covers a variety of points which, though not often questioned on, are nevertheless of great practical use.

6. *Penmanship.*—Ten minutes' daily practice in *The Practical Teacher Copy Book*, and continual care.

7. *Spelling.*—One hundred words per week, from *Words Commonly Misspelt.*

8. *Composition.*—Write one or two essays each week, on such subjects as: The Advantages of the Study of History; The Pleasures of Mischief; "This was the noblest Roman of them all;" Superstition; The Productions of the West Indies; The Results of the Seven Years' War; Pictures.

9. *English.*—

(1.) Twenty-five roots and meanings per week.

(2.) The laws of verse.

(3.) Revise the language and literature up to 1066.

(4.) *Julius Cæsar*, Act V. Finish Scene 1, and 2, 3, and 4.

Notes on "Julius Cæsar" (continued).

(1.) *Now sit we close.* An example of first person imperative.

(2.) *Myself have letters.* It is considered incorrect now to use the emphatic form of the pronoun as the subject alone.

(3.) *Therein.* Usually called relative adverb, equivalent to *in that.* (Compare *wherein, wherefrom, whereby,* etc.)

(4.) *Cicero being one.* Cicero, who had taken a leading part in the politics of the time following Cæsar's death, had, in B.C. 44, published a philippic against Antony, branding him as a monster of iniquity. When Octavius, Antony, and Lepidus entered Rome in B.C. 43, and the triumvirate was proclaimed, before proceeding east to crush Cassius and Brutus, they determined to leave no enemy behind. "Sitting with a list of chief citizens before them, each picked out the names of the victims he personally required." Antony demanded the death of Cicero, and Octavius, to the horror of all time, consented. Those proscribed were butchered with great and unnatural cruelty. Cicero escaped for a month, but was murdered as he was leaving Italy. His head was taken to Antony, and Fulvia, the wife of Antony, pierced, it is said, the tongue with a needle in revenge of the sarcasms it had uttered against her husband.

(5.) *With meditating,* etc. *Meditating* is a gerund here, governing a noun sentence.

(6.) *To endure it now.* An infinitive phrase, limiting *patience.*

(7.) *I have as much of this in art,* etc. Cassius's meaning is that though he is as familiar as Brutus with the theory of the Stoic philosophy, he could not put those principles into practice so completely as to talk of the death of his wife without emotion.

(8.) *I do not think it good.* Cassius was wise in his decision, which was overruled by the fretful, impatient Brutus. Delay would have weakened the forces of the triumvirs more than their own.

(9.) *Which we will niggard with a little rest*—that is, we will obey the call of nature to sleep, since it is a necessity; but we will not do so lavishly, but only to a slight degree.

(10.) *More to say.* Another instance of the active form of the infinitive being used in the passive sense. (Compare *bread to eat, water to drink,* etc.)

(11.) *So please you*—that is, *if it so please you.*

(12.) *Bear with me, good boy,* etc. The thoughtful consideration of Brutus for his boy is one of those exquisite touches of character so often found in Shakespeare.

(13.) *The ghost of Cæsar.* The tale goes that a terrible figure appeared to him and announced itself as his evil demon—nothing to do with Cæsar. To the dreamy enthusiast, haunted in imagination by the thoughts of his murdered friend, tired with argument and quarrel, it is quite possible that his deranged mind called up a figure which must often have been in his imagination.

(14.) *I am in their bosoms,* etc.—that is, I know their secret thoughts and reasons. They would be only too glad if they were miles away; but being compelled to fight, they make a virtue of necessity, and pretend to a boldness and courage which they do not possess.

(15.) *Something to be done*—that is, something must be done.

(16.) *Octavius, lead your battle on.* The army of Brutus and Cassius numbered at least 100,000, that of the triumvirs considerably more. Such a number of men necessarily extended over a wide area. Octavius was opposed to Brutus, but could take no part in the contest, as he was sick in his tent. His soldiers were dispersed by Brutus, while Antony defeated Cassius, the latter killing himself. Brutus, left in sole command, could do nothing with the savage legionaries under him. After a delay of twenty days he decided to renew the fight, and was totally defeated.

(17.) *I do not cross you, but I will do so.* This little rift in the lute is introduced by Shakespeare to indicate the strong, unyielding character of Octavius. Though a young man, he did not

allow Antony to have things his own way. It is hardly likely that such a dialogue ever took place. It would have been a suicidal policy to attempt to entirely change the plan of battle in the face of the enemy.

(18.) *The posture of your blows*, etc. How you can fight we know not, but your words are sweeter than the sweetest honey (said sarcastically, of course).

(19.) *If Cassius might have ruled.* Referring to his suggestion that Antony should be put to death with Cæsar.

(20.) In this conference between the rival leaders, Shakespeare has had to sacrifice historical accuracy for the sake of stage effect.

The Laws of Verse.—These are given in any good text-book. The student should be able to scan—that is, mark the accents in—any lines of poetry, to determine the kind of measure, and to know the meaning of such terms as blank verse, heroic measure, sonnet, stanza, verse.

10. *Geography.*—

(1.) Revise the geography of England.

(2.) Read up the history of the Colonies to 1763.

(3.) Revise the United States.

Notes.—The history of the growth of the empire is an essential part of the history of the country, as well as a necessary part of the geography. It is not advisable to attempt to learn too much of the details, but the main facts and dates should certainly be known; for example:—

(1.) The explorers of Elizabeth's reign.

(2.) The earliest attempts at colonisation in Virginia and Newfoundland, and the causes of their failure.

(3.) The London and Plymouth Companies, and their settlements in the States.

(4.) The East India Company—its formation and objects. Its gradual change from a mere mercantile company to the owner of vast territories.

(5.) Settlement in West Africa. The slave trade.

(6.) The circumstances under which the West Indies and Canada came into our hands.

(All these are dealt with fully in *Building of the British Empire*, Meiklejohn's series.)

In revising England, great attention must be given to trade and trade centres, imports and exports, internal communication.

Colonial Trade.

The total value of exports from the United Kingdom = £354,000,000.
Of this amount the value of exports to the Colonies = 110,000,000.
The total value of imports to the United Kingdom = 523,000,000.
Of this amount the value of imports from the Colonies = 102,000,000.

From these figures the very great importance of the Colonies as markets for home manufactured goods is apparent.

The following table indicates the character of the trade with the chief colonies, and the estimated value of such trade:—

	Imports from Great Britain.	Exports to Great Britain.
India	Cotton goods, metals, sugar, oils, machinery and railway-plant, liquors, hardware and cutlery, apparel, spices, glass, salt. Total value, £31,000,000.	Rice, seeds, cotton, wheat, tea, cotton goods, hides and skins, opium, jute, indigo, coffee, teak, lac, spices, silk. Value, £29,000,000.
Ceylon	Apparel, coal and fuel, cottons, machinery, metals. £2,000,000.	Cocoa, nuts for oil, oil, plumbago, cinnamon, tea and coffee, pearls and ivory. £5,000,000.
Straits Settlements	Cotton goods, metal goods, coal. £3,000,000.	Guttapercha, gambier, pepper, indiarubber, horns, hides, canes, sugar, rice, sago, tapioca, tobacco, gums, and tin. £7,000,000.
Hong Kong	Depot for trade in opium, sugar, etc. £3,000,000.	£1,000,000.
Borneo	Opium, tea, cottons, cloths, hardware, brass, iron. £600,000.	Sago, beeswax, edible birds'-nests, camphor, hides, rattans, tortoise-shell, trepang, cinnabar, diamonds, gold. £600,000.
Canada	Apparel, chemicals, cottons, earthenware and chinaware, hats, jute, linens, machinery, spirits, telegraph wire, woollens, wrought-iron goods. £9,000,000.	Wood and timber, animals, bacon and ham, butter, cheese, wheat, oats, pease, maize, eggs, fish, fruit, skins and furs, linseed, wood-pulp for paper. £21,000,000.
Newfoundland	(As Canada.) £600,000.	Codfish, cod and seal oil, sealskins, lobsters, copper ore. £500,000.
Bermuda	Machinery, apparel. £104,000.	Potatoes, onions, melons, pumpkins, lily-bulbs, etc. £4,683.
British Guiana	Textile fabrics, drapery, iron goods, manure. £700,000.	Sugar, rum, molasses, rubber, timber, gold. £600,000.
Honduras	Miscellaneous goods, tools, clothing, etc. £78,000.	Mahogany, logwood, sugar and various fruits, rum. £211,000.
West Indies	Apparel, cotton goods, leather, machinery, metals, and woollens. £2,000,000.	Cocoa, coffee, dyewoods, rum, spices, sugar, fruits, sponges, lime-juice. £1,700,000.
New South Wales	Apparel, arms, beer, cotton goods, iron and steel, hardware, machinery, woollen goods, paper and paints, books, spirits. £9,000,000.	Butter, copper, lead, leather, meat, frozen mutton, tallow, wool, silver, wine. £10,000,000.
Victoria	(As New South Wales.) £6,000,000.	Gold, and as above. £7,000,000.
South Australia	" £2,000,000.	Wheat, silver, copper, gold. £2,000,000.
Queensland	" £2,700,000.	Wool, gold, silver, tin, pearl and tortoise shell, meat and meat extract, fruits, oysters, bêche de mer, sugar, timber, tallow, and live stock. £3,000,000.
Western Australia	" £2,300,000.	Wool, timber, sandalwood, pearls and pearl-shells, gold. £1,000,000.
Tasmania	" £634,000.	Wool, fruit, silver, skins and furs. £300,000.
New Zealand	" £5,800,000.	Beef, butter, cheese, kauri-gum, mutton, rabbits, skins and hides, tallow, wool. £11,600,000.
Fiji	" £32,000.	Sugar, pearl-shells, maize, bêche de mer, copra and cocoa-nut oil, bananas and pineapples. £17,000.
Cape Colony	Apparel, iron and steel, cotton goods, machinery, woollen goods, coal, carriages, books, arms, cycles, leather, paper and soap, etc. £10,250,000.	Diamonds, wool, feathers, copper ore, hides, sheep and goats. £7,000,000.
Natal	Apparel, carriages, cottons, furniture, leather, machinery, metals, woollens. £3,745,000.	Sheep and wool, hides, Angora hair, skins, bark. £335,000.
West African Colonies	Cotton goods, coals, apparel, hardware, tobacco, gunpowder, spirits, salt. £2,500,000.	Rubber, palm oil, timber, palm kernels, monkey-skins, grains, kola nuts, gum-copal, hides, beeswax. £2,000,000.
East Africa	(As West African Colonies.) £145,000.	Ivory, rubber, grain, sesame, ebony. £3,860.
Mauritius	Coal, hardware, clothing. £403,000.	Sugar, aloe fibre, rum, manilla. £230,000.

11. *History.*—George the Third.

(*a*) Treaty of Paris, the terms of which were most important.

(*b*) The affair of John Wilkes. The peace was not popular, because after so many victories it was thought that the nation did not get enough from its adversaries. Wilkes attacked the king's speech, and declared that the ministers had put a lie in the mouth of the king. In the subsequent contest he had the support of the people, who shouted, "Wilkes and liberty," not because they admired the *man*, but because he was fighting for liberty of the press to criticise political action. The House of Commons, consisting largely of members from pocket boroughs, did not represent to any great extent the people of England.

(*c*) The quarrel with the American Colonies.

Causes.—(1.) The Seven Years' War had been expensive, and the Government thought that the Colonists should help to pay for it. This was quite just, but the methods of obtaining the money were not.

(2.) The Colonies were regarded as close markets for English goods, which were imported at unreasonably high prices; hence the Colonists resorted to smuggling from Spain, etc.

(3.) A fleet was dispatched to stop smuggling.

(4.) Ten thousand troops were quartered on the Colonists at the conclusion of the war.

(5.) The governments of the Colonies were tampered with.

Events.—1765. The Stamp Act passed—all legal documents to bear stamps varying in price from 3d. to £10. Strenuous resistance.

1766. The Stamp Act repealed.

1767. Imposition of duties upon glass, red and white lead, painters' colours, paper, and tea.

Steady opposition by the Colonial authorities.

1770. Repeal of all duties, except that on tea.

1773. Raiding of tea-ships in Boston Harbour, followed by coercive measures by the home government, and increased ill-feeling in the States.

1775. Hostilities commenced.

The details of the war can be studied from the text-book. There are two points which the student must notice—(1) the Colonies at first had no wish to separate from the mother country; (2) the Government failed entirely to understand the character of the men they were endeavouring to suppress. France and Spain joined in the attack on England out of revenge. The splendid victory of Rodney over De Grasse in the Battle of the Saints was the only success of importance, and this materially improved for us the terms of the ultimate settlement.

(*d*) The Gordon "No Popery Riots."

(*e*) The French Revolution, and the war which followed up to Waterloo.

Note the great importance of Nelson's victories: (1) The Nile—crushed Napoleon's dreams of an Eastern empire; (2) Copenhagen—prevented the coalition of northern fleets; (3) Trafalgar—effectually stopped the projected plan of invasion.

(*f*) The industrial revolution should also be noted. At the beginning of this reign, England was an agricultural country; at the end, it had already gone far on its career as a manufacturing centre.

(*g*) The depression during the years following Waterloo was acute. The cessation of hostilities had been followed by great depression; there were many dismissed soldiers; machinery had decreased temporarily the demand for labour; there was a huge national debt of £900,000,000, and consequently very heavy taxation.

(*h*) The union of Ireland with Great Britain.

12. *Arithmetic.*—Problems on motion, clocks, etc. Chaps. lvi., lvii., lviii., Christian and Collar.

The "clock" questions usually take the form at what time between two hours are the hands at right angles, opposite, together, at 60°, etc. The best method to solve such problems is as follows:—

At what time between three and four are the hands at right angles?

(1.) Draw a diagram with the hands in relatively correct positions. It will then be seen that the short hand must be between three and four, and the long hand between six and seven, and also that whatever distance the short hand is past three, the long hand is the same past six.

Let N = the number of minutes' spaces past three and six.

(2.) Now reckon from the last hour. The short hand has traversed N spaces, the long hand 30 + N spaces, and their rates of moving are as 1 : 12.

(3.) Therefore we get the proportion—

$$\text{As } N : 30 + N :: 1 : 12.$$

Multiply extremes and means, and equate

$$12\,N = 30 + N.$$

Deduct an N from both sides.

$$11\,N = 30,$$

$$N = 2\tfrac{8}{11}. \qquad \text{Ans. } \underline{2\tfrac{8}{11} \text{ minutes past three.}}$$

Work several exercises in the same way. The sums then become most easy.

13. *Algebra.*—Ratio and proportion. Read up the theory carefully; the questions then do not present any difficulty.

14. *Euclid.*—Props. 1–6, Book II., with six deductions per week.

15. *Elementary Science.*—Phases of the moon, lunar and solar eclipses.

16. *General Information.*—Notes of the August questions.

(1.) The various races mentioned were correctly located in nearly all cases.

(2.) The reason why there is not an apple for every bloom on a tree was not, as a rule, understood. Fertilisation is brought about by grains of pollen from one part of the flower—the stamens—adhering to the pistil, below which are the ovules, or rudimentary seeds. This is carried out by the wind, by insects, such as bees, etc., which visit one bloom after another. Many blooms are never fertilised, and some after being fertilised are destroyed by frost or by insects, and nature allows for this by providing more blooms than need be fertilised.

(3.) and (4.) were well answered.

(5.) The simple question about the wheels of the wagon produced many very ingenious theories about the centre of gravity, etc. The reason is very simple—to enable the wagon to turn by permitting the wheels to pass under the bed.

(6.) Was well answered.

(7.) The choice of the three most important battles in English history produced a wide variety of opinion. Three which certainly produced important results were Hastings, the Armada, Waterloo.

(8.) Many students failed to distinguish an iceberg from an icefloe. The former is broken off a glacier; the latter is frozen surface sea water.

General Information.

Questions for Competition.

The answers to these questions are marked gratis. They must be accompanied by the coupon of the present number and a stamped addressed envelope for return.

A prize of One Guinea is offered to the student securing the highest percentage of marks.

1. Where are the following places, and for what famous?—Pæstum, Elephanta, Fingal's Cave, Yosemite, Sandy Hook, Karnak, and Carmel.

2. Explain:—City of David, City of the Seven Hills, City of Refuge, City of London.

3. How is it possible to tell the materials of which a star is composed?

4. With what events are the following ships connected?—The *Golden Hind*, the *Centurion*, the *Victory*, the *White Ship*, the *Endeavour*, the *Challenger*, the *Shannon*.

5. Describe the different kinds of clouds. Why do some look white, others very dark? Why do they look red sometimes in the evening?

6. Who were Hercules, Orpheus, Mars, Actæon, Juno?

7. Explain:—Black Art, Black Diamonds, Black Flag, Blackmail, Black Watch.

8. What is a shooting star?

Test Papers.

(At the request of several students, I give this month some sample papers instead of the usual questions. These should be answered under examination conditions in the time allowed. The answers to all will be marked and returned, if any student desires it, for half a crown.)

Penmanship and Dictation.

(Time, ½ hour.)

Penmanship.

Large Hand—*Pietermaritzburg.*

Small Hand—*The deep-mouthed bloodhound's heavy bay*
Resounded up the rocky way.

Dictation.—(Omissions and erasures will be counted as mistakes. The words must not be divided between two lines.)

"The English, harassed by forced marches for several days previously, and still inebriated by the indulgences of the preceding night, were devoid of the enthusiasm and buoyancy of spirit which characterised the Norman chivalry. But goaded on by a desperation never to succumb without a gallant effort, Harold would not hearken to any conciliatory measures which William proposed. The latter harangued his followers, representing the inevitable disasters which would befall them in the event of a discomfiture; that they had no alternative but a decisive victory or a perpetual enthralment. Harold he stigmatised as a perjured and unscrupulous usurper, whom the Pope had anathematised. At about nine in the morning the two armies began to cross the interval which separated them, when the Norman archers poured a withering shower of arrows into the serried and impenetrable mass of the enemy, who resisted with a determination worthy of the Spartan phalanx. The tide of victory oscillated on either side as fresh reinforcements were brought to the line, till a stratagem suggested itself to the wily Norman to feign a retreat, in order to inveigle the enemy into the plain."

Geography.

(Time, 1½ hours. Answer six of the following questions, illustrating your answers, where possible, by a sketch-map.)

1. The African S.S. Company run a line of steamers to West and South-West Africa. Illustrate their course by a sketch-map, marking the chief ports they would be likely to call at. What cargoes would they be likely to take out and bring back?

2. Give some account of the most important canals of the world.

3. From whence do we obtain supplies of wine, tobacco, sugar, spices, butter, and fruits?

4. Give a short account of Corea, Titicaca, Fuji-San, and Height of Land.

5. Give a full description of any industry carried on in our Colonies.

6. Describe fully Jamaica, or Iceland, or Cyprus.

7. Take six towns in different parts of the empire which have grown very rapidly, and briefly explain the causes of their growth.

8. Explain as to a class of children how the captain of a vessel determines his position at sea.

9. Indicate briefly what facts you would select for a lesson on the St. Lawrence for Standard VI., and how you would try to make them interesting.
10. Where and what are the Bosphorus, Cevennes, Crimea, Levant, Matterhorn, Riviera, Tyrol, Wolds, and Wrekin?

HISTORY.

(Time, 1½ hours. Answer four questions, *two* from each section.)

Section A.

1. State any changes consequent upon the Norman Conquest to (*a*) the clergy, (*b*) the barons, (*c*) the people.
2. Write a short account of *three* of the following:—Langton, Wiclif, Owen Glendower, Cardinal Morton, Cardinal Pole.
3. What important events or persons were associated with Bec, Bouvines, Lincoln, Wallingford, Lewes, and Stamford Bridge?
4. Explain the objects of the Test Act, the Schism Act, the Repeal of the Test and Corporation Acts.

Section B.

1. Describe the events leading to, and the results of, the following battles:—(*a*) The Nile, (*b*) Copenhagen, (*c*) Corunna, (*d*) Waterloo, (*e*) Navarino.
2. Give a short description of *three* of the following:—Navigation Act, East India Company, National Debt, Reform of the Calendar.
3. Give an account of how and when England obtained *three* of the following:—Newfoundland, Jamaica, Bombay, Gibraltar, Quebec.
4. Write notes of a lesson upon some great battle in English history, illustrating your method by a plan.

ARITHMETIC.

(Time, 2 hours. Answer eight questions.)

1. (*a*) Prove that $\frac{3}{4}$ of $\frac{2}{3}$ of a unit = $\frac{1}{2}$ of the same unit.
(*b*) Explain as to a class of children the working of this sum: "In what time will the simple interest on £650 amount to £130, at 5 per cent. per annum?"
(*c*) How would you work this sum on a blackboard so as to explain it to a class of children?—"The sides of a triangle are proportional to 2½, 3, 3½. The sum is 338 feet. Find each side."
2. One pendulum oscillates in $\frac{11}{12}$ of a second, and another in $\frac{13}{14}$ of a second. If started simultaneously, how often will they tick together in an hour and a half?
3. Find the value of $\frac{\cdot040575}{1\cdot623}$ of £26, 13s. 4d. + $\frac{3\cdot553}{2\cdot09}$ of £30, 1s. 8d. − $\frac{\cdot02144}{\cdot067}$ of £25, 8s. 4d.
4. A man buys coffee at £8, 10s. a cwt., and chicory at £2, 10s. per cwt., and mixes them in the proportion of five parts of chicory to seven of coffee. If he sells the mixture at £7 per cwt., what is his gain per cent.?
5. A works for 6 days at the rate of 7 hours a day; B works for 5 hours on the first day, and on each of the subsequent five days one hour longer than on the preceding day. A does as much work in 9 hours as B does in 10 hours. If the total sum paid to them as wages for the week be £4, 2s. 6d., how much should A receive?
6. What percentage does a shopkeeper make whose prices are 30 per cent. above cost price, if he allows his customers 15 per cent. on their bills?
7. In what time will £8825 amount to £11119, 10s. at 4 per cent. simple interest?
8. What sum must a man invest in the 2¾ per cents. at 99 in order to have a clear income of £195, after paying an income-tax of 6d. in the £ (neglect brokerage)?
9. Explain how you would teach one of the following processes to a class of children:—(1) Long division; (2) cancelling fractions; (3) simple proportion.

MUSIC.

(Time, ½ hour. Answer five questions.)

1. Write in the Lah Mode (*a*) an ascending minor scale, using the minor essential sixth and the major essential seventh; and (*b*) a descending minor scale, using the minor seventh and the minor sixth.
2. Write the following intervals:—
(*a*) Above *lah* an augmented sixth.
(*b*) Above *se* a diminished third.
(*c*) Above *doh* an augmented fifth.
3. Rewrite the following on the imperfect method. Regard the first note in (1) as *doh*^{1} and the first note in (2) as *me*:—
(1) s l f m r f t, d r m f e s d' t.
(2) l t d'. s l f s m f l s l t d'.
4. Copy and write figures over the following to indicate the value of each note and rest in pulses and fractions of a pulse:—

| m . f . s : d . | m . . f : s . | l . , s : f , m . r | s : . ‖

5. Transcribe the following into six-pulse measure—that is, write in three pulses what is here in one:—

| m : d . r . m | f : − | s . . f : m . . f | s : | f . s . f : m ‖

6. State the meanings of the following terms:—Transition, Bridge Note, Legato, Agitato, Fine, Larghetto.

COMPOSITION.

(Time, 1 hour.)

Write an essay on one of the following subjects:—
1. A shipwreck.
2. "There is a perennial nobleness in work."
3. The character of Julius Cæsar.

(*Papers in remaining subjects will be set next month.*)

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1903.

1. *Reading.*—Regular and careful practice should be devoted daily to this subject, and regular *oral* lessons, with questions on the meaning, held.

2. *English.*—Ver. 17–20, Gray's *Elegy in a Country Churchyard.*

Ver. 17. "But though their lowly life prevented them from acquiring fame, it also precluded the possibility of their committing great crimes. They could not, like Cromwell, cause bloodshed to gratify their ambition, nor inflict merciless cruelty and suffering on others."

Alone. Adjective, qualifying *virtues.*
Supply *were* after *crimes.*
Read—Their lot forbade them to, etc.
To wade and *to shut.* Infinitives, governed by *forbade.*

Ver. 18. "They were not compelled to stifle the natural dictates of their conscience, nor to suppress their sense of shame, nor to use the highest forms of poetical genius in flattering the wealthy and proud."

In the last two lines Gray is referring to a custom which was in vogue up to the time of Johnson. As there was a limited reading public, an author frequently had to print by subscription—that is, he went round to wealthy men and solicited their favour to the extent of buying a copy before it was printed. With the money thus obtained the printing was paid for, and the author kept what was over for himself. It must have been particularly galling to an educated man to have to hawk his works, and to be compelled to toady to and flatter the wealthy and ignorant.

To hide, to quench, to heap. Infinitives, governed by *forbade* in ver. 17.

Ver. 19. "Living, as they did, right away from the sordid, exciting struggle for wealth in great cities, and being ignorant of it, they never longed for any different form of life, but passed a quiet, even existence in this calm, retired spot."

Read—*They being far,* etc. An absolute construction. *Far,* an adjective, qualifying *they.*
To stray. The gerundial object of *learned.*

Ver. 20. "Yet although they do not rest in some beautiful cathedral under a splendid tomb, some attempt has been made to prevent their names and the position of their graves from being wholly forgotten. A rough tombstone, with crude carving and wretched rhymes, appeals to the sympathy of the passer-by."

Analyse thus:—Connective word = *yet.* Subject = *memorial.* Enlargement, *some frail.....still erected nigh to protect these bones from insult, decked with uncouth rhymes and shapeless sculpture.* Finite verb = *implores.* Object = *tribute.* Enlargement, *the passing.....of a sigh.*

E'en. Adverb of emphasis, modifying *these.*
To protect. Infinitive of reason to *erected.*

3. *History.*—Henry the Seventh and Henry the Eighth.

This period is very important, and must have the closest attention. It is usually recognised as the commencement of a new era—modern history. The invention of printing, the spread of learning (the Renaissance), the geographical explorations, the Reformation, produced in a short time a wonderful change. The chief points in Henry the Seventh's reign are—

(1.) Who he was, his title to the throne, his marriage.
(2.) How he acquired money—(*a*) Morton's Fork, (*b*) Empson and Dudley, (*c*) the Star Chamber, (*d*) confiscation of Yorkist estates, (*e*) grants from Parliament. His wealth rendered him independent of Parliament.
(3.) The rebellions, and how they were dealt with.
(4.) The marriages of his children, and their important results.
(5.) The reasons why he and his children possessed so much power—
(*a*) The nobility had been nearly destroyed by the Wars of the Roses.
(*b*) The Commons were anxious for peace, and not strong enough to resist the royal power.
(*c*) The church was weakened by the Reformation, and depended on the king.
(*d*) The king possessed the only artillery in the kingdom, against which personal strength was useless.
(*e*) The wise character of the Tudors, who were excellent statesmen.

Henry the Eighth's reign may be divided into two great periods—
(*a*) Wolsey's administration. Learn a good biography.
(*b*) The period of the Reformation. Read up and enter into notebook answers to the following questions:—
(1.) What was the Reformation? What did the Reformers want?
(2.) What causes brought about the Reformation?
(3.) Sketch its progress in England (note that Henry the Eighth, though he separated himself from the church, was not a Reformer).
(4.) Who were the chief men connected with the movement in England?

4. *Geography.*—The Welsh counties. Learn a map of Wales with proper lines of latitude and longitude, and the names of all important places.

5. *Arithmetic.*—Decimals (excluding recurring decimals).

Make quite sure of the theory. What is a decimal fraction? In multiplication of decimals arrange the lines to show the exact value. The usual way is not a good one—for example, $3{\cdot}25 \times 12{\cdot}5$.

Arrange as follows:— 3·25
12·5

1·625 = ·5 times top line.
6·50 = 2 ,,
32·5 = 10 ,,
40·625 = 12·5 ,,

The decimal point must appear in each line in the proper place.

6. *Euclid.*—Book I, Props. 11–14.

7. *Algebra.*—Chap. vii., Hall and Knight. Insertion and removal of brackets.

8. *Elementary Science.*—Pulleys; inclined plane; screw; wheel and axle.

9. *Music.*—Mental effects and how they are modified.

Test Questions.

1. *Penmanship.*
Large Hand—*Cardinal Wolsey.*
Small Hand—*Slow rises worth by poverty depressed.*

2. Analyse the following, and parse words in italics:—

"*Perhaps* in this neglected spot is laid
Some heart *once pregnant* with celestial fire;
Hands that the rod of empire *might have swayed*,
Or *waked* to ecstasy the living lyre."

3. Give all the suffixes you know which change nouns into adjectives.

4. Say what you can of the Peasants' Revolt under these heads—(*a*) causes, (*b*) events, (*c*) results.

5. Describe, with a sketch-map, the valley of the Severn.

6. Work the following:—

(*a*) A man who has lost $\frac{1}{2}$ of $\frac{\frac{1}{2}}{\frac{1}{2}-\frac{1}{10}}$ of his capital has £3500 left. What did he lose? Ans. £7000.

(*b*) A man, after spending $\frac{1}{2}$ of his money, and then $\frac{1}{3}$ of the remainder, and then $\frac{1}{4}$ of what then remained, had £25 left. How much had he at first? Ans. £100.

(*c*) $\frac{1}{5}$ of a draper's stock was destroyed by fire, $\frac{1}{7}$ of the rest was injured by water. He sold the injured goods at $\frac{1}{2}$ cost price, and realised £225. What did he lose by the fire?
Ans. £1775.

(*d*) At a school divided into 4 classes $\frac{1}{4}$ of the children are in the first, $\frac{3}{14}$ in the second, $\frac{1}{7}$ in the third, and in the fourth 6 children more than half the number in the first three. Find the whole number. Ans. 126.

(*e*) A man gives away to each of four people $\frac{1}{12}$, $\frac{2}{21}$, $\frac{3}{28}$, $\frac{5}{21}$ of a basket of apples, and has only just enough apples to do so without dividing an apple. How many had he? Ans. 420.

(*f*) A man left $\frac{5}{12}$ of his estate to one son, $\frac{1}{3}$ of the remainder to another, and the rest to his widow. The difference in the sons' legacies was £784. How much did the widow receive?
Ans. £1829. 6s. 8d.

7. Explain the three kinds of levers, and give examples of each.

8. What do you understand by pitch?

First and Second Years.

1. *Reading and Repetition.*—Daily practice should be taken, with *oral* lessons weekly.

2. *English: First Year.*—Cowper's *Task*, Book V., lines 160–201, or Cowper's *Expostulation*, lines 161–200.

Second Year.—Milton's *Paradise Lost*, lines 266–343.

The meanings of all allusions and the derivations of the chief words must be learned.

Special Study.—(*a*) The noun. Gender and case. Note the different ways of forming the feminine, and the words which have different words for masculine and feminine. In case, learn exact definition, and the meanings of—

(1) Nominative absolute; (2) nominative in apposition; (3) nominative of exclamation; (4) direct and indirect objective; (5) objective absolute; (6) cognate, factitive, adverbial objects; (7) residual object; (8) ethical dative.

(*b*) Palgrave's *Golden Treasury of Songs and Lyrics.*

Study Nos. 88 and 89.

No. 89. See note on page 355. *Andrew Marvell* (1620–1678). Educated at Cambridge, was engaged in 1657 as Milton's assistant in the Foreign Secretary's Office. Member for Hull and patriotic supporter of Parliament. "He wrote with great liveliness, point, and vigour, though often coarse and personal. His poetry is elegant rather than forcible."

Lycidas.—This poem was written in 1637, and marks the close of Milton's younger efforts. Edward King, a college friend of Milton, was sailing from Chester to Dublin to visit his home; the ship struck on a rock, and he was drowned. His fellow-students desired to commemorate him by poems in Greek, Latin, and English, and Milton wrote the English poem.

The young student will find some difficulty in the fact that the poem is written in the pastoral style, which was common enough at and before this time. Milton expresses his relations with King under the guise of one shepherd lamenting for another—for example, "we fed the same flock by fountain, shade, and rill," means "we studied together." Johnson, in his *Life of Milton*, criticises the poem somewhat harshly. "The diction," he says, "is harsh, the rhymes uncertain, and the numbers unpleasing. It is not to be considered as the effusion of real passion; for passion runs not after remote allusions and obscure opinions. Passion plucks no berries from the myrtle and ivy, nor calls upon Arethuse and Mincius. When there is leisure for fiction, there is little grief.....We know they never drove afield, and that they had no flocks to batten, etc. Surely no man could have fancied that he reads *Lycidas* with pleasure, had he not known its author."

This is hardly fair. To judge the poem, it must be looked at from Milton's point of view. It is not the natural expression of sorrow, "but of admiration and regret expressed with careful art and special artistic form." It is only to be appreciated after careful study.

Underlying the lament is the grave expression of uneasiness at the state of the church of that time (*vide* "How well could I have spared for thee," etc.), the expressions of an earnest Puritan concerning the Episcopal Church.

Study this poem carefully, and do not spare a little effort to get at the real meaning.

3. *History: First Year.*—Henry the Fourth and Henry the Fifth, and Henry the Sixth up to the Wars of the Roses.

Second Year.—George the Third up to 1800.

Chief Points.—Henry the Fourth. His title to the throne. The plots against him. The growth of the power of the Commons up to the Act of 1430, which deprived many people of the power of voting. The Lollards; the Statute "De Heretico Comburendo."

Henry the Fifth. Campaign in France: causes and results.

Henry the Sixth. Loss of the French province, owing to the Burgundian alliance being broken.

George the Third. See notes under Scholarship.

4. *Geography: First Year.*—Asia generally. Physical features, climate, and productions.

Second Year.—Central America and the West Indies.

(Notes on the West Indies were given in last month's Scholarship Course.)

There is only one way of learning geography thoroughly—by the judicious use of notebooks and maps. After a careful digest of facts has been made, it must be committed to memory, and map-drawing is a most useful help to doing this.

First year pupil teachers should draw maps of Asia, and insert all places to be remembered, until it can be done correctly from memory.

The following questions have been asked:—

Asia.—(1.) Give some account of the Indus and Euphrates.

(2.) What do you know of the Caspian Sea and its shores?

(3.) Name two important groups of islands lying off the coast of Asia, and write fully about one of them.

(4.) Describe the chief lakes or inland seas of Asia, stating any circumstances which make any of them important.

(5.) "The mountain chains which enclose the Chinese Empire form the great watershed of Asia." Name the mountain chains, and show the truth of the statement.

(6.) Describe four of the chief rivers of Asia, their sources, and the sort of produce which is carried on them.

(7.) What Asiatic rivers flow into (*a*) the Sea of Aral; (*b*) the Persian Gulf; (*c*) the Arctic Ocean.

(8.) "Asia throws out large offshoots on two of its sides; the gulfs which penetrate it are all the more valuable for commerce, inasmuch as great rivers flow into them." Explain and prove this.

Central America and West Indies.—(1.) Write a letter home describing the impression of an Englishman on visiting Jamaica for the first time.

(2.) What is our chief trade with the West India Islands? How was trade affected by the emancipation of slaves? Write a short account of Jamaica.

WEEKLY REVISION TESTS IN MATHEMATICS FOR SCHOLARSHIP AND MATRICULATION STUDENTS.

With Hints and Solutions.

THESE tests, consisting for the most part of questions given in the above examinations, are arranged to cover a definite portion of the course during each week, as follows:—

Test I. Algebra—to simple equations; Geometry—Book I., 1–26.

Test II. Algebra—simple equations, factors; Geometry—Book I. 27–41.

Test III. Algebra—H.C.F., L.C.M., fractions; Geometry—Book I. 42–48.

Test IV. Algebra—quadratics, ratio, proportion; Geometry—Book II.

Suggestions for Use.—Revise portions of work indicated from text-books. Then work each test without assistance of any kind, allowing one hour for each section. Afterwards compare results with the given answers and solutions, and refer, when necessary, to portions of text-books indicated. These will be Hall and Knight's *Elementary Algebra*, and Hall and Stevens's *Euclid*.

Other tests will follow, dealing with the whole of the above syllabus generally.

I.

A. 1. Define, and illustrate by examples, the terms factor, index, coefficient, and dimension. When is an expression said to be homogeneous? If two homogeneous expressions be multiplied together, of what nature is the product?

2. What is the difference in meaning between $a - (b - c)$ and $(a - b) + c$? Prove that they are equal. Can you interpret both quantities when a is smaller than b?

3. Given $2x = 3$, $4y = 3$, $z = -2$, find numerical values of—

(*a*) $\sqrt{(8y + 2z + 7)} + \sqrt{(6x - 8y + z)}$.

(*b*) $\dfrac{x}{y} + \dfrac{4x + 2z}{2x - z}$.

(*c*) $xy + yz - zx$.

4. Prove that $a \times b = b \times a$, where a and b are any positive integers.

From $2\{b - 2a - \frac{2}{3}(b - a) + a\}$ take $\frac{1}{3}\{b - a - (a - y) + x - y\}$.

5. Divide the sum of $2p^4x - 2p^3x^2 + 4px^4$ and $p^4x + 2p^3x^2 - 5p^2x^3 - x^5$ by $p^2 + px - x^2$.

B. 1. Define parallel straight lines, an acute-angled triangle, and a rhombus. What do you understand by a postulate, a corollary, and a theorem?

2. In a given straight line find a point that is equidistant from two given points. When is this impossible?

3. What is a converse proposition? Give instances from I. 1–26. What method of proof is usually employed?

4. Show how to construct a triangle, having given the base, a line equal to the difference of the other sides, and the angle at the base opposite to the greater side.

5. In the triangle ABC the sides AB, AC are equal, and the angle BAC is a right angle. In BC take a point D and join AD; through A and C draw lines intersecting in E, such that AE is at right angles to AD, and CE at right angles to BC; show that AE = AD.

II.

A. 1. Solve—(*a*) $\dfrac{2a}{x - \frac{a}{6}} = \dfrac{3b}{x - \frac{b}{3}}$.

(*b*) $x + 2y = 2x + 3y - 2 = 3x + 5y - 6$.

2. Solve—

(*a*) $ax + by = 2ab$; $bx - ay = b^2 - a^2$.

(*b*) $5x - 3y + z = a$; $2x + 5y - z = 2a$; $2x + 3y + z = a$.

3. In a factory there are 62 workmen, and the total amount of their weekly wages is £74, 6s. A certain number of them receive 40s. a week, twice as many receive 29s. 6d. a week, and the rest 17s. a week. Find the number receiving each rate of wages.

4. Two boys (A and B) spent 2s. 3d. in apples and oranges; each got the same number of fruits, though the one boy (A) got three times as many apples as the second, and the second boy (B) got twice as many oranges as the first. If every four apples cost 3d., and each orange cost 1d., how much money did each boy spend?

5. Factorise—

(*a*) $x^3 + 2x^2 - 9x - 18$.

(*b*) $4x^2 - 13x + 10$.

(*c*) $x^2 + 9y^2 - 1 + 6xy$.

(*d*) $x^4 + 4x^2y^2 + 16y^4$.

(*e*) $\frac{1}{8}x^3 + \frac{1}{27}y^3$.

(*f*) $(x - 1)(x - 2)(x - 3) + (x - 1)(x - 2) - x + 1$.

(*g*) $12x^2 + 3xy - 8xz - 2yz$.

(*h*) $(1 + xy)^2 - (x + y)^2$.

B. 1. Define a parallelogram. Show that a parallelogram is bisected by a diameter. Two straight lines are drawn bisecting each other, and the ends of the lines are joined to form a four-sided figure; show that this figure is a parallelogram.

2. Show how to divide a right-angled triangle into two isosceles triangles, and hence prove that the straight line from the middle point of the hypotenuse to the right angle is equal to half the hypotenuse.

3. If two straight lines AB, CD intersect in X, so that the triangle AXC is equal to the triangle BXD, show that AD and CB are parallel.

4. Show that a trapezium is bisected by the straight line which joins the middle points of its parallel sides.

5. Prove that the line joining the middle points of any two sides of a triangle is parallel to the third side.

III.

A. 1. Show that the L.C.M. of any two expressions is found by dividing one of the expressions by their H.C.F. and multiplying the quotient by the other expression. Find H.C.F. of $7x^4 - 10x^3 + 3x^2 - 4x + 4$ and $8x^4 - 13x^3 + 5x^2 - 3x + 3$.

2. X is taken n times from Y with remainder Z. If $mZ = X$, show that Z is the G.C.M. of X and Y.

Factorise the following expressions, and write down in factors their L.C.M.: $x^3 - 8x + 12$; $3x^2 - 20x + 12$; $3x^3 - 2x^2 - 12x + 8$.

3. Prove that $\dfrac{a}{b} \div \dfrac{c}{d} = \dfrac{ad}{bc}$, where the letters denote any numbers.

Simplify—

$$\left\{\frac{a + \frac{b^2}{a}}{a + b} - \frac{a - b}{a - \frac{b^2}{a}}\right\} \div \frac{1 - \frac{a}{b}}{1 - \frac{a^2}{b^2}}$$

4. Substitute $\dfrac{a - 1}{a + 1}$ for x in each of the following expressions, and reduce the results to their simplest forms—

(*a*) $\dfrac{1}{1 - x} + \dfrac{1}{1 + x}$. (*b*) $\dfrac{2 - 3x}{4 + 5x}$.

5. Simplify—

$$\left(x^2 - \frac{2x}{x - 1}\right) \times \frac{x^3 - 1}{x^3 - 1} \div (x^3 + x^2 + x).$$

B. 1. Define "complements" and "parallelograms about a diagonal." Prove that parallelograms about a diagonal of a square are squares.

2. Give a definition of a square free from redundant conditions, and show that the sum of the squares on the diagonals of a rectangle is equal to the sum of the squares on its four sides.

3. If the square described on one side of a triangle is greater than the sum of the squares described on the other sides, the triangle is obtuse-angled.

4. Show how to describe a triangle equal to any quadrilateral, and having an angle equal to a given angle.

5. Describe a square whose area shall be three times that of a given square.

IV.

A. 1. Find the condition that the roots of $mx^2 + nx + c = 0$ may be real and positive.

Solve $10(x^2 - 1) = 21x$.

2. Prove that if a quadratic equation has one real root, it has in general another; and explain a simple way of finding the second root when the first is known.

Solve $ax^2 - b^2x = c(ac - b^2)$.

3. There are two positive numbers whose sum is 6, and the ratio of the first to the second exceeds the ratio of the second to the first by two; find the numbers.

4. When are four magnitudes proportional?

Show that a ratio is made more nearly equal to unity by adding the same quantity to each of its terms.

5. Define ratio. Does it follow from your definition that it would be wrong to speak of the ratio of 5 tons to 3 miles, and if so, how does it follow?

For what relations of x will the ratio of $x^2 - 7x + 2$ and

$x^2 - 8x + 10$ be equal to the ratio of 2 to 3? Verify your results by substitution.

B. 1. Define gnomon; rectangle; segments of a line.
What is the objection to the use of algebraical processes in demonstrating the propositions of the second book?
2. Show that the square on a straight line is four times the square on half the line.
3. If ABC be a triangle in which C is a right angle, and DE be drawn from a point D in AC at right angles to AB; prove that the rectangles AB . AE and AC . AD will be equal.
4. Construct a rectangle equal to the difference of two squares.
5. Given the base of a triangle and the sum of the squares on the other sides, find the locus of its vertex.

Solutions.

I.

A. 1. See H. and K., pars. 5, 7, 6, 24. Product will be homogeneous, and dimension of product will be equal to the sum of the dimensions of the factors.
2. $a - (b - c)$ = the quantity that must be added to $(b - c)$ to make a; $(b - c)$ being the quantity that must be added to c to make b. Similarly for $(a - b)$, and $(a - b) + c$ is the result of adding c to it. To prove equality, see H. and K., par. 22.
When $a < b$, the expression $(a - b)$ is arithmetically without meaning. So is the first, if c is greater than b or $(b - c) > a$.
3. (*a*) 4; (*b*) $2\frac{2}{3}$; (*c*) $2\frac{1}{2}$.
4. $a \times b = a + a + a + \ldots\ldots$ to b terms
$= 1 + 1 + 1 + 1 + \ldots$ to a ,,
$+ 1 + 1 + 1 + 1 + \ldots$ to a ,,
$+ \ldots\ldots\ldots$
to b rows.
In the same way treat $b \times a$. Hence number of units in each corresponds. (*b*) $\frac{1}{2}(b - x)$.
5. $3p^2x - 3px^2 + x^3$.
B. 1. See H. and S., definitions.
2. Take AB, str. line; C, D points. Join CD. Bisect in E. Draw EF at rt. ∠s to CD, meeting AB in F. This is the point required. Prove by I. 4.
Construction fails when EF is parallel to AB.
3. See H. and S., p. 178.
Converse Props. 5, 6; 13, 14; 18, 19; 24, 25.
4. Take AB, base. At A make ∠BAC = given angle. Produce CA to D, making AD = given difference. Join DB. Make ∠DBC = ∠BDC. Then CAB is triangle required. Prove.
5. ∠BAD = ∠CAE (Ax. 3). ∠ABD = ∠ACE, each being half rt. ∠. Hence, I. 26, AD = AE.

II.

A. 1. (*a*) $\frac{ab}{12a - 18b}$. (*b*) $x = 0$; $y = ?$.
2. (*a*) $x = b$; $y = a$. (*b*) $x = \frac{3a}{8}$; $y = \frac{3a}{16}$; $z = -\frac{5a}{16}$.
3. 9, 18, 35.
4. A 1s. $0\frac{3}{4}$d.; B 1s. $2\frac{1}{4}$d.
5. (*a*) $(x + 2)(x + 3)(x - 3)$.
(*b*) $(4x - 5)(x - 2)$.
(*c*) $(x + 3y + 1)(x + 3y - 1)$.
(*d*) $(x^2 + 2xy + 4y^2)(x^2 - 2xy + 4y^2)$.
(*e*) $(\frac{1}{2}x + \frac{1}{3}y)(\frac{1}{4}x^2 - \frac{1}{6}xy + \frac{1}{9}y^2)$.
(*f*) $(x - 1)(x - 1)(x - 3)$.
(*g*) $(3x - 2z)(4x + y)$.
(*h*) $(x + 1)(x - 1)(y + 1)(y - 1)$.
B. 1. H. and S., p. 62. Prop. 34, part (*b*).
Prove by I. 4 (included angles being equal by I. 15).
Angles in each triangle are equal to each other. Then use I. 27.
2. Take ABC for triangle, C being rt. ∠. Then ∠C = ∠s A and B (I. 32).
At C in AC make ∠ACD = ∠CAD. Then ∠BCD = ∠CBD.
Hence, I. 6 and Ax. 1, AD = BD = CD.
3. Add to each triangle AXD. Then use I. 39.
4. Take E, F, middle points of AB, CD. Join ED, EC.
Then △s EDF, ECF are equal, and △s AED, BEC are equal (I. 38).
5. Take D E, middle points of AB, AC. Join DC, EB.
△s ADE, BDE are equal; also △s AED, CED (I. 38).
∴ △DEB = △DEC (Ax. 1).
And DE and BC are parallel (I. 39).

III.

A. 1. H. and K., par. 102. $x^2 - 2x + 1$.
2. $Y = nX + Z = nmZ + Z = (nm + 1)Z$. $X = mZ$. ∴ H.C.F. = Z.
$(x - 2)(x - 6)$. $(3x - 2)(x - 6)$. $(x + 2)(x - 2)(3x - 2)$.
∴ L.C.M. = $(x - 2)(x + 2)(x - 6)(3x - 2)$.
3. H. and K., par. 158. $\frac{b}{a}$.
4. (*a*) $\frac{(a + 1)^2}{2a}$. (*b*) $\frac{5 - a}{9a - 1}$.
5. $\frac{x - 2}{x - 1}$.
B. 1. H. and S., p. 76. II. 4, first part of proof.
2. An equilateral and equiangular quadrilateral. Also see H. and S. definitions.
An easy exercise on I. 47.
3. Let ABC be given △, construct another △ DEF having DE, DF = AB, AC, and EDF a rt. ∠. Then prove BC > EF.
∴ square on BC > square on EF. Hence, I. 25, ∠BAC > ∠EDF.
4. Let ABCD be given quadrilateral. Join BD. Through A draw AE parallel to BD, meeting CB produced in E. Join ED.
△DEC = quadrilateral. Make ∠ECF = given ∠, and produce CF to meet a line through D parallel to EC. Join EF for required △.
5. Let AB = side of given square. Draw BC at rt. ∠s to AB and equal to AB. Join AC.
Square on AC = 2 square on AB. Draw CD = AB at rt. ∠s to AC. Join AD.
Square on AD = 3 square on AB.

IV.

A. 1. (*a*) To be real $\sqrt{n^2 - 4mc}$ must be positive.
To be positive $\frac{c}{m}$ must be positive—that is, c and m must have like signs.

$$x = \frac{5}{2}, \text{ or } -\frac{2}{5}.$$

2. Let $px^2 + qx + r = 0$ be the equation.

$$\text{Roots are } \frac{-q \pm \sqrt{q^2 - 4pr}}{2p}.$$

If one root is real, quantity under radical cannot be negative, hence other root is also real.
Product of roots = $\frac{r}{p}$. Hence, for second root, divide product by known root.

$$x = c, \text{ or } \frac{b^2 - ac}{a}.$$

3. $3\sqrt{2}$ and $6 - 3\sqrt{2}$.
4. H. and K., pars. 295, 293.
5. H. and K., par. 283. Yes, because by definition quantities must be of the same kind.

$$x = 7, \text{ or } -2.$$

B. 1. H. and S., pp. 120, 121, and 131.
2. II. 4, twice the rectangle contained by the parts of the line being equal to twice the square on half the line.
3. Join BD. Two rect. AB . AE + BE^2 = BA^2 + AE^2 (II. 7).
Add ED^2 to each.
Substitute BD^2—that is, (BC^2 + CD^2), for (BE^2 + ED^2), AD^2 for (AE^2 + ED^2), and (BC^2 + CA^2) for BA^2 (I. 47).
Two rect. AB . AE + CD^2 = CA^2 + AD^2.
Substitute two rect. CA . AD for (CA^2 + AD^2 − CD^2) (II. 7).
∴ Rect. AB . AE = rect. CA . AD.
4. Let A and B be sides of square.
Make CD = A. Produce to E, making DE = A.
Cut off DF = B. Then rect. CF . FE = difference on squares on A and B (II. 5).
5. H. and S., Ex. 24, p. 147. Locus is a circle, whose centre is at the middle point of the base of the triangle.

The Practical Teacher has in the past taken a prominent part in the work of International Correspondence, and we propose in future to offer our assistance to those of our readers who may either desire to find a French or German family with whom they could spend a holiday, or be willing to receive a French or German teacher under similar conditions. Full particulars will be announced later on.

One of our friends of the Corrèspondance Internationale wishes to recommend a French teacher, B. ès Lettres, etc., as teacher of French and Latin in an English school, *au pair*. Information of a suitable opening may be sent to the Editor, 35 Paternoster Row.

GENERAL INFORMATION FOR SCHOLARSHIP.

We shall this month endeavour to explain some of the principal financial and commercial terms and expressions.

Barter.—In early times, and among primitive races, all trade consisted of *bartering*—that is, the exchanging of one article for others of nearly corresponding value; in this way the Red Indian used to barter his furs for beads, firearms, etc. As civilisation advanced, "tokens" were introduced—that is to say, instead of exchanging for sheep or oxen, the person received pieces of metal representing these animals. These "tokens" constituted *money*, which is simply a medium of exchange—the name being derived from the goddess Juno Moneta, in whose temple money was first coined. We are still reminded of the origin of money by the word "pecuniary," which is derived from the Latin *pecua*, meaning herds of cattle.

Bullion is the name given to gold or silver before it is coined.

The Mint.—All English coins are made at the Royal Mint on Tower Hill, and the making of coins by unauthorised persons, even though such coins may be of the proper standard and value, is illegal.

Gold Coins.—Sovereigns and half-sovereigns are issued at almost their precise value as bullion, and any person taking gold to the Mint, up to the value of £20,000, can have it coined free of charge. Gold coins contain twenty-two carat gold and two carat alloy, mostly silver. One ounce of pure gold is worth £4, 4s. 10½d., but one ounce of mint gold is worth £3, 17s. 10½d.

The *Guinea*, which is no longer coined, derived its name from the fact that it was first made of gold brought from the Guinea Coast.

Silver Coins are not issued at their value as bullion. The market value of one pound troy of pure silver is less than thirty shillings, but it is coined into thirty-six shilling pieces, the Government thus making a profit (known as seignorage) of over six shillings on every thirty-six shillings issued.

The *Groat* was a silver coin of Edward the Third, worth four pennies.

Bronze Coins are made of an alloy consisting of 95 per cent. copper, 4 per cent. tin, and 1 per cent. zinc. They also represent more than their intrinsic value.

The following are some of the principal foreign coins in use at the present time, with their approximate values:—Franc (France, Belgium, etc.), 9½d.; dollar (United States), 4s. 1½d.; mark (Germany), 11¾d.; rouble (Russia), 3s. 2d.; rupee (India), 1s. 10½d. The smallest coin is found in Portugal, where values are calculated in "reis," one thousand reis being worth 4s. 5½d.; China runs this close, where one thousand cash make one tael, which is worth 6s. 6½d.

Paper Money.—Strictly speaking, the only paper money is a note issued by the Bank of England; but promissory notes, bills, and bank-cheques, although not legal tender, are generally accepted as money.

Legal Tender is anything that a person is by law bound to accept in payment of a debt. A person is not obliged to accept a cheque unless he chooses, but he is bound to accept Bank of England notes, or gold to any amount, silver coins up to the value of £2, and copper coins to the value of a shilling.

Bank-notes.—All banks, except those within a radius of sixty-five miles of London, are allowed to issue notes, but only those of the Bank of England are legal tender. These are carefully printed on specially-prepared paper; they are never issued a second time after returning to the bank. At first sight, the printing and issuing of bank-notes would appear to yield an enormous profit, as the face-value of a note is far beyond its intrinsic value; but this is not so, as the bank has to retain in its vaults a corresponding amount of gold or bullion, except 15 millions, which it is allowed to issue on security of money lent to the Government.

A *bill of exchange* is a request that a sum of money shall be paid to a particular person. Thus, suppose Jones of London purchases goods of Blanc of Paris, the latter draws up a bill—

£5,000 PARIS, *1st Sept. 1902.*

Three months after date, pay to me or my order the sum of five thousand pounds, value received. JEAN BLANC.

To MR. THOMAS JONES,
Snow Hill, London.

This bill is said to be *drawn* by Blanc, and is sent to Jones, who, if he intends to pay the money, writes the word "accepted," with the date and his signature across it, and returns it to Blanc. Jones is now said to have accepted the bill—that is, to have acknowledged his liability to pay the sum named at the given date.

The Principle of Exchange.—Blanc now holds a bill, and hundreds of merchants in Paris may hold similar bills, but the money to pay these bills is deposited in the banks in London. If, now, a person in Paris wishes to send money to London, instead of transmitting gold or bank-notes, he goes to the money-market and purchases one of these "bills," which he sends to the person in London, who is then able to obtain the cash from the London bank on which it is made payable.

The Rate of Exchange.—The amount that has to be paid for this bill above (or below) its nominal value is called the rate of exchange, and depends on the relative amounts that London owes Paris and that Paris owes London. If these amounts are equal, exchange is at par, as they just balance one another. If there are fewer bills in Paris, a premium must be paid, and the exchange is said to be *against* London.

A *Promissory Note* is a written promise to pay a specified sum of money at a certain date, and differs from a bill in that the person paying the money draws it up.

Promissory notes are passed from hand to hand. Each person *endorses* it—that is, signs his name on the back—before passing it on. When the note becomes due, the holder obtains the money from the person who originally drew the note; but should that person be unable to pay, the last endorser is responsible.

Bank-cheques.—A cheque is an order for money drawn by a person possessing a current account, and is payable on demand.

To lessen the risk of fraud, cheques are frequently crossed by drawing two oblique lines across them, either with or without the words "and Co." A crossed cheque is payable only to a banker.

The *Bankers' Clearing House* is a central establishment to which bankers send every evening the various cheques they have received during the day. These are sorted and checked, and the accounts between the various banks made up. The most important clearing-house is in Lombard Street.

Banks.—The chief uses of a bank are: (1) To receive deposits; (2) to make loans and issue notes; (3) to transmit money.

Savings-banks are banks which are established, not with a view to making a profit, but for the purpose of encouraging thrift by receiving and allowing interest on small deposits.

Banks may be either private or joint-stock banks. A private bank is one that is conducted by private persons with their own capital, such as Rothschild's, Baring's, etc.; a joint-stock bank is conducted by a company, the capital being subscribed by the shareholders.

The Bank of England was established in 1694 by William Paterson, for the purpose of lending money to the Government. Its original capital was £1,200,000, but this has been gradually augmented, until it now stands at 14½ millions.

In return for the services rendered to the Government, the bank enjoys various privileges.

1. It is the Government banking-house, all money drawn as taxes being consigned to the keeping of the Bank of England; it also manages the National Debt.

2. Its notes have special privileges, as seen in this article.

3. The charter of the bank fixes its price for bullion at £3, 17s. 9d. per ounce, whereas, as we have seen, the Royal Mint allows £3, 17s. 10½d. As, however, it is quicker to change bullion into money at the bank than at the Mint, people, as a rule, prefer to take the lower price, and this yields a considerable profit to the bank. The principal entrance to the bank is in Threadneedle Street, hence the expression, "the old lady of Threadneedle Street," which is frequently applied to it.

The *Stock Exchange* in Capel Court, opposite the bank, is the meeting-place of those who wish to buy or sell shares and stocks.

Members of the Stock Exchange are divided into "jobbers" and "brokers."

A *Jobber* is a man who deals on his own account.

A *Broker* is one who acts under instructions, and buys or sells for another person, who pays him commission.

Settling Day.—Very few of these dealings are ready-money transactions, the various accounts being settled twice a month, or, in the case of consols, once a month.

Bulls and Bears.—Hence we see that after a deal in shares the price may alter before settling-day; this gives rise to many gambling speculations. A bull buys for settlement at a future date with a view of gaining by a rise in price in the interval; a bear sells, hoping to gain by a fall before settling-day.

Contango and Backwardation.—Should the market not alter in the manner expected, the bull pays a sum to postpone settlement until next settling-day: this is known as "contango." Similarly the bear pays a certain sum in consideration of not being called on to deliver the stock: this is called "backwardation."

OUR CERTIFICATE COURSE FOR 1903.

BY GEORGE COLLAR, B.A., B.SC.,
Head-Master of the Stockwell Pupil Teachers' School.

TEST QUESTIONS ON LAST MONTH'S WORK.

Theory of Teaching.

1. In what way would you co-ordinate the teaching of English grammar and composition?

2. It is sometimes urged that in English schools the pupils are too passive, and do not learn to express themselves. What steps would you take to avoid this in teaching your class?

English Language and Literature.

1. At what periods have words of Latin origin come into the English language? How do you distinguish between words of "learned origin" and words of "popular origin"?

2. How can you distinguish between words of French origin that have been adopted into the English language, and French words used by English writers?

3. Comment on the syntax of the line—

"Thy honour, state, and seat *is* due to me."

English History.

1. To what extent can the Crusades be considered as successful enterprises? Give an account of their effects on the nations of Western Europe.

2. Trace the steps that led to the grant of Magna Charta. What were its chief provisions?

Geography.

1. Give an account of the mineral and vegetable products of Spain and Portugal.

2. Write a short account of the chief industries of Italy.

Arithmetic.

1. Simplify—

$$\frac{660}{1409} \times \left\{ 6\tfrac{5}{12} \div 20 + \frac{70}{5\frac{5}{8}} - 2\tfrac{4}{13} \times \left(\frac{1\frac{1}{6} + 2\frac{1}{12}}{28\frac{7}{8} - 25\frac{3}{4}} \right) \div 1\tfrac{1}{13}\tfrac{3}{2} \right\}.$$

2. State and prove the rule for dividing one vulgar fraction by another.

Algebra.

1. Simplify—

$$\frac{\dfrac{1}{a^2 + ab + b^2} + \dfrac{1}{a^2 - ab + b^2}}{\dfrac{2a^2 - 2b^2}{a^4 + a^2b^2 + b^4}}.$$

2. Solve the equations—

$$(a)\ \frac{8x - 15}{27} - \frac{5x - \dfrac{2x - 1}{7}}{18} - \frac{x - 30}{12} = \frac{1}{36};$$

$$(b)\ \begin{cases} \dfrac{x + y + 1}{3} + \dfrac{2x + 3y + 1}{10} = x \\ 3x + \dfrac{2y + 1}{11} + \dfrac{x - y + 1}{3} = y. \end{cases}$$

Euclid.

1. Describe a parallelogram of given perimeter that shall be equal in area to a given rhombus, the given perimeter being greater than that of the rhombus.

2. The line joining the middle points of two opposite sides of a square is at right angles to each of them.

Science.

1. What is meant by an element? Give the "law of combination in definite proportions by weight."

2. What is the "law of multiple proportions"? How was it deduced?

SYLLABUS AND NOTES FOR OCTOBER.

English Composition.

Study carefully Nichol, Part II., chaps. ii. and iii., on *Purity and Propriety in the Use of Words.* These chapters treat the subject in a very able manner, and the student will profit by the careful perusal of them. We might express an opinion, however, that "safeguarded" has now passed into such common use that it might be withdrawn from the list of newly-coined words that Nichol advises students not to use. In any case it is advisable to avoid using an unfamiliar word more frequently than is necessary.

Prepare notes for essays on—

1. The Pleasures of Childhood.
2. Methods of Travelling.
3. The Study of Poetry.

Theory of Teaching.

Students who are studying languages should read chap. ix. of the school management text-book, as the principles there laid down for teaching languages will be found useful to all who study them, as well as to those who teach.

The teaching of history will form the subject of study this month. Chapter x. of Collar and Crook should be thoroughly mastered. Take the various points in order—objects and value, moral teaching, patriotism, a means of training (*a*) the imagination, (*b*) the memory, (*c*) the judgment. Of these, the first is frequently neglected altogether, the second degenerates into "cram," while the third is pressed too early. The judgment is the last of the mental powers to mature, and even when the judgment is ripe, it can only be exercised when the *facts* of the case have been thoroughly mastered. Hence the teacher must be careful not to assume that children can deduce a connection between historical events with the attendant circumstances of which they are not familiar.

The subject of school hygiene is required for the 1903 examination, and the syllabus is set out in fair detail. We propose to deal with ventilation this month.

Pure dry air contains as nearly as possible 21 volumes of oxygen and 79 of nitrogen in every 100. The amount of carbon dioxide is extremely small, being only ·04 volume in 100. When the air has been breathed, these proportions are altered; for although the amount of nitrogen remains the same, the amount of oxygen is reduced, as about 5 of the 21 parts are used up in one complete act of breathing. The expired air, therefore, contains about 16 parts of oxygen in every 100. But it is most important to realise this reduction as a fraction of the total oxygen, rather than as a percentage of the whole air taken into the lungs, and it will be seen that at one inspiration five twenty-firsts, or over 20 per cent., of the essential part of the air are used up. On the other hand, the quantity of carbon dioxide increases from ·04 to about 4·3 per cent., the amount of watery vapour is largely increased, the temperature is raised, and a certain amount of organic waste matter is given off. In schoolrooms objectionable matter is given off not merely from the lungs of the children, but from their skin and clothes, particularly in the case of those coming from homes in which the use of soap and water is not sufficiently practised. Dirty garments are most harmful when wet. Respiration cannot be carried on properly if the supply of oxygen is deficient, or if there is a great excess of carbon dioxide. Recent experiments, however, go to show that the latter gas is not so poisonous as was formerly imagined, but the harmful effects arising from continued breathing of the same air result rather from the organic matter which accumulates. Fortunately, this poisonous matter can generally be detected by the smell; and if the air of a schoolroom is so tainted that it has a distinct odour perceptible to a person entering it from the fresh air, it is unwholesome, and must be replaced. Physiologists estimate that with only the ventilation that takes place through the chimney, the cracks of the windows and doors, and the pores of the brick walls, 1,000 cubic feet of air is not too much for each person. But if we take a schoolroom 12 feet high, filled with children on the "9 square feet basis," this allows only 108 cubic feet of air per child; hence there is very evident necessity for continually changing the air. In order to prevent the vitiation of the atmosphere, about 200 times the volume of air actually breathed should be brought into the room. Children breathe at the rate of about 25 inspirations a minute—more if they are active, fewer if quite still—and give out about 12 or 15 cubic inches each time; hence for each child there should be admitted into the room about 2,000 cubic feet per hour. The amount will be found to be supplied for a class of fifty by having openings of 10 square feet area through which the air can enter at the rate of about two miles an hour.

If ventilation is systematically neglected, the health of the children suffers: the system becomes weaker, and very susceptible to infectious diseases. The temporary effect is shown in drowsiness and loss of activity, and the lack of oxygen leads reflexively to yawning and sleepiness, which are evidently not due to

fatigue, as the child begins to play vigorously as soon as he gets into the open air.

The central problem in ventilation is the exchange of bad air for fresh in such a way that no draught should play upon the children. This exchange may be brought about either by diffusion—that is, a motion among the particles of air—or by the motion of masses of air as the result of differences of pressure. The former plays a very important part in ventilation by producing a uniformity of quality in the air in different parts of the room; and in the case of walls made of brick, a great deal of air diffuses through the walls. This is greatly reduced if the walls are painted; hence the advantage of colouring the walls with distemper, and not paint. The amount of fresh air introduced in this way is far from sufficient, and we must depend upon air introduced by pressure. This pressure may be produced naturally—that is, by natural rise of temperature—or artificially, by heat or mechanical contrivances. It is generally assumed that "hot air rises and cold air comes in below;" but the teacher will find that, owing to winds and other circumstances, he may have air *leaving* by the *bottom* of the window and *entering* at the *top*. In order to prevent the draught from the bottom of a window from inconveniencing those who sit near, a vertical board should be fastened across the inside; this will be found to give an upward direction to the current of air, which afterwards mixes with the rest of the air in the room. During playtime all the windows and doors should be left open, so as to cause a thorough renewal of the air in the whole room. Ventilating holes are frequently made in the wall. They require to be protected by gratings: if near the top, should have a trap, such as Sheringham's ventilator, to prevent a down-draught; and if near the floor-level, they should have a wooden or metal shaft (Tobin's tube) to direct the air upwards.

Any source of heat may be utilised in ventilation as a means of removing impure air. Heated air naturally passes up an ordinary chimney; and if the gas-burners are placed at the bottom of tubes communicating with the outside, they will render great service in renovating the air of the room. In some cases a current of air is caused by a rotatory fan, but the plan is seldom adopted in schools.

English Language and Literature.

Study the introduction of Greek words into English. These have come into the language in two principal ways—through the Latin, and directly from the written Greek. Of late years it has been the custom to make up names for new inventions from Greek roots. Hence such words as *photograph*, *telephone*, *microscope* are formed from Greek roots; but it is needless to say that the compounds themselves are not Greek. The words that were introduced through the Latin naturally underwent great changes; and it is only by tracing the words back through old writings that we know that such words as *priest*, *bishop*, and *alms* are of Greek origin. As words have come through two channels, we might expect that in some cases the same Greek word has given rise to two modern forms; and such is the case. Of the doublets that have been thus formed, the word which has come through the written language tends to keep its Greek look, while the other has undergone great modifications, though less in sound than in sight: compare *phantasy* and *fancy*, *balsam* and *balm*, *paralysis* and *palsy*, *blaspheme* and *blame*.

Prepare in detail *Richard the Third*, Act II.

Scene i., line 8. *Dissemble not your hatred.* "Dissemble" is really a negative word, meaning to pretend that anything does not exist which does. Hence the sentence means, do not *pretend* that you do not hate—that is, be free from hatred in reality.

11. *So thrive I* = so may I prosper.

32–40. Notice how this was fulfilled. After helping Richard to obtain the throne, Buckingham rebelled against him; but his forces were unable to act in consequence of the flooded state of the Severn, and he was betrayed by a trusted servant, and executed at Salisbury, 1483.

49. *Charity.* Here used in its original meaning of "love."

57. *Hardly borne*, that presses with hardship.

60, 72. These lines may be added to the list of quotations illustrating Richard's character. The first shows his hypocrisy, the second his pride or his hypocrisy. For if Richard really believed that he was humble, he was guilty of the most despicable display of pride in boasting of his humility, besides proving thereby that he had not the virtue of humility; if he knew it was false, then he was guilty of great hypocrisy in thanking God for a quality he knew he did not possess.

76. "To pardon our brother Clarence."

88. *Mercury* was the messenger among the gods.

129. *Beholding* = beholden.

Scene ii., line 18. *Incapable*—literally, not able to hold; unable to comprehend.

27. *Such gentle shapes*—that is, as the pretence to love and protect the children whose father was killed.

35. *Hinder me to wail*, hinder me from wailing. "Hinder" is never used now with the infinitive.

50. *His images*, his children. The thought of her love and duty to their children sustained her in the grief caused by the loss of her husband. The same thought is worked out in Tennyson's beautiful lines—

> "Home they brought her warrior dead.
> . . . . . .
> Sweet, my child, I live for thee."
>
> *The Princess*, vi.

60. *Moiety* = half.

61. *To overgo thy plaints*, to exceed thy complaints; to go beyond thee in complaining.

62–65. These spiteful little speeches are not quite in keeping with boy and girl character, nor is their wording childish. The lamenting match which follows is one of the weak spots in the play. When people feel real sorrow, they do not vie with one another in expressing it.

81. *Parcelled*, made of small parts. "Parcel" is a doublet with "particle," and means a little part.

93. *Much more to be thus opposite*, much more should you be called ungrateful if you show opposition to Heaven.

107. The duchess knows Richard's real character, and prays that he may be endued with those virtues which she knows him to lack.

144. *To give your censures*—literally, to give your judgments; that is, to give your counsel or advice.

148. *I'll sort occasion*, I'll choose an opportunity.

149. As an introduction to the plan we lately discussed. In Shakespeare's day it was more usual to place the index at the front of the book than it is now; hence index stands for introduction or opening.

151. *Consistory.* Originally the meeting-place of the privy council of the Roman emperors; thence applied to the privy council itself. The secret council of the high dignitaries of the Roman Catholic Church is called a consistory. Hence Richard proclaims Buckingham as his bosom friend and confidential adviser.

Scene iii., line 4. *Seldom comes the better*, the less frequently we hear such news the better it will be for us.

8. *God help the while*, may God help our time or period.

11. *Woe to that land that's governed by a child.* This is based upon Eccles. x. 16: "Woe to thee, O land, when thy king is a child." In the Latin version this is in the third person, as in our text: "*Vae terrae ubi rex puer est.*" This is quoted in *Piers Plowman*, where it refers to the minority of Richard the Second.

34. *Parlous*, talkative (from Fr. *parler*, to talk). *Shrewd* originally meant cursed; here "cunning."

64. *Spleen*—that is, anger. The different passions and emotions were supposed to have their origin in different internal organs, and the names of these organs were often applied to the feelings themselves.

English History.

Prepare reigns of Henry the Third and Edward the First.

John's rage after he had been compelled to grant Magna Charta led to such acts that the people invited Louis, the son of Philip, King of France, to come over and accept the crown. Fortunately in this time of division John died, and the Earl of Pembroke was able to rally the dissentients round John's son, and to proclaim him king as Henry the Third.

The Great Charter was renewed, and Pembroke ordered the sheriff of each county to cause it to be read openly in full county court. This charter differed in some respects from that of John. Provisions of a merely temporary nature were omitted; but the most important alteration referred to the levying of scutages. The original charter recognised the king's right to levy aids on three occasions—the coming of age of his eldest son, the marriage of his eldest daughter, and to provide a personal ransom if he were a prisoner; but it refused to recognise the claim of the king to levy scutages (or money payments in lieu of military service) at his own discretion, and placed the control of all these levies in the hands of the Great Council. In place of these clauses, the new charter stated that it had been decided to leave the discussion of these and kindred subjects to a more convenient season.

At the time of John's death, London and the greater part of England were in the hands of Louis; but the bold defence of

Dover and the glorious naval victory gained by Hubert de Burgh, August 24, 1217, and the defeat of the Count of Perche by the Earl of Pembroke at Lincoln, delivered England from all fear of French domination. By a wise policy Pembroke allowed the French to withdraw to France, and granted an amnesty to those Englishmen who had sided with Louis, and thus succeeded in reuniting the people with the crown.

The government of England by Hubert de Burgh, the Justiciar, and Peter des Roches, Bishop of Winchester, requires close attention, particularly in connection with the efforts of Cardinal Pandulph, the papal legate, to rule England on behalf of the Pope. From this domination the country was saved by the energy and patriotism of Archbishop Langton.

The work and life of Simon de Montfort (as far as known) are treated with sufficient fullness in the text-books. Great distress was prevalent in 1257, and the king's foolish act in seizing a cargo of corn greatly increased the disaffection. A parliament was summoned to meet at Oxford, which the barons attended with armed troops. This is often called the "Mad" Parliament, but nothing in its actions justifies such a name. This parliament obtained a solemn confirmation of the Great Charter, the redress of certain grievances, the placing of fortresses in the hands of Englishmen only, and the appointment of a council of twenty-four guardians of the laws. For three years all went well, but dissensions among the barons induced Henry to believe that he could resume full powers of government. By means of large bribes, Henry induced Pope Alexander to annul the oaths he had taken to respect the Provisions of Oxford. The barons took up arms to maintain their liberty, and defeated Henry at Lewes in May 1264. De Montfort now became real ruler of England, although he governed in Henry's name. In the name of the king he summoned a parliament to meet at London on the following 20th of January. This parliament marks an epoch in constitutional history, for it was the first in which the cities and boroughs were represented. Having quarrelled with De Montfort, De Clare, Earl of Gloucester, made terms with the royalists, and so united that party that De Montfort was defeated and killed at Evesham. The powerful influence of Prince Edward brought about such a state of tranquillity that he was able to go on a Crusade, and although he did not return till two years after his father's death, affairs all went on tranquilly in England.

Edward the First's reign is an extremely important one, and one that must be studied without prejudices, for many of his acts are grossly misrepresented, and wrong motives are too readily assigned. It is not an uncommon thing to state that as soon as Edward came to the throne he determined to bring the whole island under one rule. But we have no evidence that he ever had such an idea; and the fact that five years passed before the first war with Wales, and eighteen before he interfered in the least with the affairs of Scotland, seems to prove that he had no such intention.

We shall endeavour to give an impartial summary of the events next month.

Geography.

Study in outline the geography of Austria-Hungary and the Balkan Peninsula.

Austria-Hungary.—Learn boundaries and divisions; note that the only coast-line consists of a short stretch on the Adriatic, with the ports Trieste and Fiume; the Danube and its tributaries partly compensate for this deficiency as regards foreign commerce, and provide excellent means of internal communication.

In studying the "build" of the country, note the following features, using a sketch-map, and marking in the chief points:—

(*a*) The mountains, including the *Bohemian System*, encircling the table-land of Bohemia; the *Alpine System*, in the Tyrol and south-west; the *Carpathian System*, extending in a great curve from Pressburg, on the Danube, to the Iron Gate.

(*b*) The plain of Hungary, watered by the Middle Danube; note the character of surface, products, etc.

(*c*) The plateau of Bohemia.

The country as a whole is well suited for agriculture, the only wastes being some of the high mountainous districts, some marshes near the rivers, and the district called Karst, near Trieste. The climate exhibits great variety.

The products are also varied and important. The country is rich in minerals, but they are not very well worked. *Agriculture* is by far the most important industry, especially in Hungary. Excellent wine (Tokay) is produced, and Hungarian horses are famous. *Manufactures*, which are rapidly developing, include cotton, woollen, and linen goods, glass, and sugar (from beet). Mark the centres on the map.

Commerce, important and increasing—maritime trade with Great Britain and countries round the Mediterranean; overland trade with neighbouring countries.

Internal trade is very important, the manufacturing towns of north and west exchanging their products with the agricultural districts of the south and east.

The population of the Austro-Hungarian Empire demands close attention, as it is necessary to understand the social and political problems of the day, which will become still more important in the future. There are four chief races, which may be subdivided.

1. The *Slavs*, who are generally slow and slovenly; though the Czechs, of Bohemia, are enterprising and well educated. Besides the Czechs, there are Poles and Ruthens in the north, and Wends, Croats, and Serbs in the south. There is a strong race feeling against the other sections of the empire, especially among the Czechs, many of whom wish to make Bohemia independent.

2. The *Teutons*, who occupy the western parts, such as Upper and Lower Austria, Styria, Carinthia, and the lower Tyrol.

3. The *Romanic* people, who inhabit the upper Tyrol (chiefly Italian), and Roumanians, who occupy the greater part of Transylvania.

4. The *Magyars*, or Hungarians, who are descended from the Huns, who invaded Europe at the break-up of the Roman Empire. Their language and characteristics resemble those of the Finns, and they are generally considered to belong to the Mongolian family, and not to the Aryan or Indo-European group.

Besides these well-defined groups, there are numbers of Jews, particularly in the east; and Armenians, Albanians, and Greeks in the south-east; and bands of gypsies roam about in all parts.

Mark on the map the localities inhabited by the different races, and observe how the distribution of industries coincides with the division of races.

In studying the *Balkan Peninsula*, it is well to pay attention to the historical development of its political divisions.

Arithmetic.

Study the theory of decimals; there is much that demands careful preparation in this subject. Among the special points to work at are:—Conversion of vulgar fractions to decimals, and the conditions under which vulgar fractions will give rise to the different kinds of decimals; theory of division, including nature of remainders; contracted methods of multiplication and division (very important); theory of recurring decimals. These points are all fully explained in chaps. xxii. and xxiii. of Christian and Collar's *Arithmetic*. If these matters are thoroughly mastered, the student will often see short methods of working when he comes to the practical part.

Algebra.

Problems on simultaneous equations. The chief difficulty arises from not remembering that x, y, etc., are *abstract numbers*, and the equation sets out a relation between numbers. In stating what x and y are assumed to represent, always state that they denote numbers and not concrete quantities. Never say, "Let x = the price," etc., as the same price might be given in pence, shillings, or pounds, and an equation might easily be made between prices, which will not help to solve the problem. Say, "Let x = the *number* of pence" (or pounds, etc.), and establish a relation between this number and other numbers that are given, and then you may determine what the number is.

Euclid.

Revise Book II.

Elementary Science.

Indestructibility of Matter.—The law of indestructibility of matter tells us that by no human power can matter be destroyed or put out of existence. At first sight we might think that it can, as, for example, water left in an open vessel disappears; articles may be burned, and leave either nothing at all or a quantity of ash which weighs much less than the original body. In these cases, however, careful observation shows that the body does not undergo annihilation, but only change of form. The water takes up the gaseous form and passes away as vapour, which may be recovered by condensation. In the case of combustion we find that if the products are collected there is actually an increase in weight, which on further examination proves to be equal to the loss in weight which the air undergoes by the loss of its oxygen. The experiment with the burning candle should be worked, and a sketch made of the apparatus

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employed. Other experiments are frequently given in the text-books, and should be prepared.

Comparatively small quantities of the elements are found in a state of nature in an uncombined condition. Among them we may mention oxygen, nitrogen, carbon (as diamond and plumbago), and sulphur; while of the metals, those with high atomic weights are found free—such as gold and platinum, and occasionally silver and copper. But generally natural matter is compound and complex. Many compounds of carbon were until three quarters of a century ago supposed to be producible by living plants or animals; hence they were, and are, called *organic*. When formed into cells, and employed in the structure of animals or plants, such matter is said to be *organised*, and in that state is highly complicated in its composition.

LOGIC FOR L.L.A. AND LONDON MATRICULATION.

BY T. E. MARGERISON, M.A. (LOND.),

Principal of the Tottenham Pupil Teachers' Centre.

III.

Logical Definition.—Accurate thought is only possible when the terms which we use have a fixed and known meaning; hence an important division of logical doctrine is *definition*, which enables us to give a precise and fixed meaning to every term capable of having such a meaning assigned to it. A proposition which sets forth the meaning of a term is called its definition. To be a logical definition, the proposition must express the qualities on account of the possession of which the name is given to the thing—in other words, it must state the connotation of the term. Hence the logical definition of a term is a precise statement of its connotation.

In seeking a definition, it is necessary to analyse the meaning of the term to be defined, and to determine exactly what qualities form its connotation. This process is by no means easy, as we shall find if we try to apply it to the commonest terms of everyday use. What, for instance, is the definition of "cat"? There is little difficulty in indicating what we mean by the term, but the method is not by logical definition; we name some of the more prominent characteristics, without any attempt to be exhaustive, our aim being merely to give a correct index to what the term denotes. Probably the qualities named are not part of the connotation at all, but merely *propria* or *accidents*. Such statements of meaning are *descriptions* of the thing named, but not *logical definitions* of the term. They enumerate some of the attributes of the thing, and so enable us to identify it; but to the logician they are not definitions, because they do not declare the whole of the facts which the name involves in its signification.

The definitions of the dictionary are, as a rule, in the case of common words, descriptions rather than logical definitions. Probably they are of more practical value in that form than the most correctly framed scientific definition would be.

Limits of Definition.—From what has been said of the nature of definition and of the connotation of terms, it is evident that not all terms admit of definition. If a definition expresses the meaning of the term, then terms which have no meaning cannot be defined. Non-connotative terms, as proper nouns and singular abstract terms, are therefore incapable of definition.

"Per genus et differentiam."—When the connotation of a term is ascertained, the definition might proceed by enumerating all the attributes included in it. But this method would be unnecessarily tedious. The usual plan is to state the genus of which the term names a species, it being assumed that the connotation of the genus is known. To complete the definition the *differentia* is added, to distinguish the species named by the term defined from all co-ordinate species of the same genus; hence the old rule that a definition should proceed "per genus et differentiam"—that is, by genus and difference. Thus in the definition of an island as "land surrounded by water," "land" is the *genus*, and "surrounded by water" the *differentia*, or the excess of the connotation of the species "island" over that of the genus "land."

Rules of Definition.—A logical definition must also conform to certain simple rules, of which the chief are as follows:—

1. *It must contain neither more nor less than the connotation of the term defined.* If it contains less than the whole connotation, the definition will be inadequate, and may apply to things other than those denoted by the term defined. It is then said to be *too wide*. For instance, the definition of a "square" as "a quadrilateral with equal sides" would include a rhombus. The fault lies in the omission of part of the connotation of a "square"—namely, the quality of being right-angled. If, on the other hand, the definition embrace more than the connotation, it may be made *too narrow*—that is, it will apply only to part of the objects named by the term. The definition of "pen" as "a metallic instrument for writing with ink" is too narrow, for it applies only to a part of the things correctly named "pens," quill pens being excluded. In this example "metallic," a *separable accident* of the class "pen," has been added to the connotation. The inclusion of a *proprium*, or an *inseparable accident*, is a less serious error, as it does not affect the denotation; for example, if a "right-angled triangle" is defined as "a triangle having one angle a right angle and the square on one side equal to the sum of the squares on the other two," the definition includes all right-angled triangles, and nothing else. It is, however, a faulty definition on account of the inclusion of a proprium of the class which (1) makes the definition unnecessarily long, and (2) implies that there are triangles possessing one of the attributes named without the other.

2. *It must not contain the name or any synonym of it.* A definition violating this rule fails to perform the primary function of a definition—namely, to unfold the meaning of the term. To say that "boldness is audacity" is no definition; the second term is merely a re-statement, in another form, of the first, and we are brought no nearer the meaning. Similarly in the definition of "a law" as "a lawful command," the repetition of the term to be defined leaves us without knowledge of its meaning. These are examples of what is known as "circulus in definiendo"—that is, "a circle in defining." Owing to the bi-lingual character of our language, we have in English a large number of pairs of words with nearly equivalent meaning—one word of the pair coming from a classical, and the other from a native source. This error in definition is therefore rendered easy, and is somewhat common.

3. *It should be clearer than the term defined, and therefore must not be expressed in obscure, figurative, or ambiguous language.* This rule, like the last, follows from the purpose of a definition. If the terms employed in the definition are unknown, then certainly no light is thrown on the meaning. The fault is that of defining *ignotum per ignotius*, the unknown by the more unknown. Famous examples are Dr. Johnson's definition of a net as "a reticulated fabric decussated at equal intervals;" and Aristotle's definition of the soul, "the Entelechy or first form of an organised body which has potential life." It should be noted that in applying this rule to estimate the value of a definition, regard must be paid to the purpose for which the definition was framed. The definition of a scientific or technical term is often expressed in language almost, if not quite, unintelligible to any one who is not a student of the branch of knowledge to which the term belongs. Figurative language does not constitute a definition. To say, "The camel is the ship of the desert," or "The oak is the monarch of the woods," does not give the meaning of "camel" and "oak" respectively.

4. *It should not be negative when it can be affirmative.* Breach of this rule also prevents the definition from fulfilling its main purpose. If it is to give the connotation of the term, it must state what it *is*, not merely what it is not. To exclude a few attributes can, as a rule, give little indication as to what qualities must belong to a thing to place it in the class named by the term defined. Euclid's definition of a point is a familiar instance of a breach of the rule. Negative terms form an exception to the rule. Since the name is given on account of the absence of some quality, the negative form is here preferable.

QUESTIONS.

(Students can have their solutions corrected by sending them, with seven stamps, to the Editor, Elementary Logic Course, PRACTICAL TEACHER.)

1. What is meant by the logical definition of a term? Distinguish definition and description.
2. Explain the statement that a definition should proceed "per genus et differentiam."
3. What terms do not admit of definition? Illustrate.
4. State the chief rules to which a logical definition must conform.
5. Criticise the following definitions:—

(1.) Honesty is the best policy.

(2.) An equilateral triangle is a triangle with all its sides and angles equal.

(3.) A house is a brick building for dwelling in.

(4.) Mind is not matter.

(5.) The eagle is a bird of prey.

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Liquefaction of Carbon.—Dr. A. Ludwig has succeeded in liquefying carbon by subjecting it to enormous pressure. The carbons of an electric arc-lamp were introduced into a pressure vessel, and when the pressure reached 1,500 atmospheres, the arc between the carbons failed; and though an electromotive force of 70 volts was applied, the current entirely failed to span the gap. According to Dr. Ludwig, the carbons had, in their passage to the liquid state, become non-conducting.

Artificial Diamonds.—Dr. Ludwig also succeeded in obtaining the crystalline modification of carbon, or diamonds, by suddenly cooling the pressure-vessel by an inrush of cold water. In the hard gray mass found in the vessel at the end of the experiment unmistakable diamonds were found to be present.

The Colour Changes of Cobalt and other Chlorides.—Messrs. F. G. Donnan and H. Bassett make the above the subject of a communication to the Chemical Society. They say that the colour changes exhibited by aqueous and alcoholic solutions of the chlorides of cobalt, copper, and ferric iron on variation of temperature or dilution, or on the addition of various chlorides—such as those of H, Ca, Mg, Zn, or Hg—are shown to be largely due to the formation or dissociation of complex unions containing a metallic atom in association with chlorine. Evidence was brought forward to show that the dehydration theory is inadequate to explain the observed phenomena. Experiments on the motion of boundaries between different liquid layers on the passage of an electric current point to the existence of complex negative ions. Thus in the case of cobalt chloride, the blue solutions travel towards the anode, the red solutions towards the cathode. Further experiments on the combination between cobalt and other chlorides in aqueous and alcoholic solutions admit of explanation on the above hypothesis.

The Preparation of Pure Chlorine, and its Behaviour towards Hydrogen.—Messrs. J. W. Mellor and E. J. Russell are responsible for the following contribution on this subject to the Chemical Society:—A quantity of carefully dried and purified silver chloride was placed in a V-shaped tube of the hardest Jena glass, in which were also inserted, as electrodes, stout carbon rods specially prepared for the electrolysis of fused salts. An air-tight joint having been made, the salt was fused, and a current of 2·8 amperes passed through. Chlorine was evolved in a steady stream. Foreign gases and moisture were removed by occasional reversal of the current and repeated exhaustion with an automatic Sprengel pump.

The silver tree was destroyed by raising the temperature and increasing the current to five amperes. The tree then either melted or was shattered; electrolysis was discontinued until the former temperature was restored. When started again, it was found to proceed in a normal manner.

Hydrogen was prepared by the action of steam on sodium, and was absorbed by palladium. The whole apparatus was then exhausted, the palladium heated, and hydrogen evolved.

The gases were sealed up in the inner and outer bulbs respectively of the condensers now largely used in the Soxhlet extractors. Each bulb contained a quantity of carefully-purified phosphorous pentoxide, the inner bulb containing also a small piece of glass rod. After drying for some months in the dark, the vessels were shaken, to break the inner bulb, and the gases mixed by diffusion. Only condensers which had approximately equal capacities for the inner and outer bulbs were used; hydrogen was put in at the same pressure as the chlorine; so that the volumes of the two gases were nearly equal.

A small electric spark passed through the mixture so obtained caused an explosion, and the combination was found to have been practically complete. Apparently drying does not affect the action of the spark.

Mixtures of dried hydrogen and chlorine in similar bulbs were found to explode at about 260°. One of the bulbs containing the purified mixture was, therefore, heated to 270° for some minutes, but no explosion took place. On opening the bulb it was found that there had been practically no combination. Another bulb was heated for ten minutes to 450°. Still no explosion occurred, but about 80 per cent. of the mixture had combined. Some of the phosphorous pentoxide had volatilised, and as it was found impossible to heat the gases without also heating the pentoxide, it is still uncertain whether this slow combination is a direct action or a surface action. Another bulb was exposed to bright sunshine at Wye for three days, but no explosion took place, and only about 30 per cent. of the hydrogen and chlorine had combined.

Separation of Cobalt and Nickel.—Mr. R. L. Taylor, F.C.S., of the Central School, Manchester, strongly recommends the following method (due to Rose) of separating these provokingly similar metals:—The mixed sulphides of cobalt and nickel are dissolved in the usual way in dilute hydrochloric acid with the aid of a crystal of potassium chlorate. The liquid is then boiled down just to dryness, in order to expel the free acid. The residue is taken up with water, and precipitated barium or calcium carbonate and bromine water added. It is now allowed to stand for five minutes, with frequent shaking. If cobalt is present, a black precipitate very soon appears. At the end of five minutes the liquid is filtered, and the filtrate tested for nickel by the addition of a drop or two of ammonia and ammonium sulphide. The presence of cobalt in the precipitate may be confirmed by the borax-bead test. In this way nickel may be detected, even when present in very small quantities, and when the cobalt is largely in excess. Instead of boiling off the free acid, it may be neutralised with sodium or potassium hydroxide before adding the carbonate and bromine water; or the carbonate of barium or calcium may be added in excess to the acid liquid, and then the liquid boiled for a short time to expel the carbon dioxide. It must then be cooled to the ordinary temperature before adding the bromine water.

Determination of Copper by Aluminium Foil.—The copper is brought into solution as a sulphate. Water is added until the dilution is about 50 c.c. of water to 10 c.c. of sulphuric acid. Sheet aluminium of about 25 gauge thickness is cut into pieces about 40 mm. square, with one corner of each piece turned up for convenience of handling. Two or three of these pieces are added to the beaker containing the solution of copper. The solution is then boiled. In about five minutes all the copper is precipitated upon the aluminium sheets.

Instead of re-dissolving the deposited copper and titrating with cyanide solution, more satisfactory results are obtained by washing the deposited copper into a tarred Gooch crucible, by giving a final wash with alcohol, and by burning off the alcohol and drying. Weigh the resultant as metallic copper.

In forming the filter, care should be taken that only sufficient asbestos fibre is used to produce a good filter. In washing with alcohol and burning the same, care is needed, as in the electrolytic method, that too much alcohol is not used.

Action of HCl on the Sulphates of Al, Cr, and Fe.—The author, A. Recouna, experiments on the behaviour of solutions of the salts of sesquioxides of aluminium, chromium, and iron when they are reacted upon by an acid different from that of the salt. He finds that the sulphate of chromium sesquioxide, for example, under the action of heat dissolves a portion of the sulphuric acid set free. The result of this decomposition in presence of another acid weaker than sulphuric acid—such as

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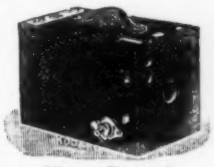

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hydrochloric acid when used in great excess, has the power of fixing one or more molecules of hydrochloric acid, giving rise to a polyacid salt in which the hydroxyls of the base are saturated, some by the sulphuric, others by the hydrochloric acid. By using this method, the author obtained the two polyacid salts $AlSO_4Cl \cdot 6H_2O$ and $CrSO_4Cl \cdot 6H_2O$; whilst with the sulphate of iron he transformed ferric sulphate $Fe_2 3SO_4$ into an acid sulphate $Fe_2 3SO_4, SO_4H_2, 8H_2O$.

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Hypothesis on the Nature of Solar Prominences.—Professor W. H. Julius has described before the Amsterdam Royal Academy of Science the following theory as to the nature of the prominences.

It may be remembered that Professor Julius accounted for the doubling of the arcs in the spectrograms obtained by him during the last total solar eclipse by saying that it was due to the anomalous dispersion of the chromospheric light, and he now applies this theory of anomalous dispersion to account for solar prominences. He abandons the idea of the existence of various layers of different materials in the solar atmosphere, and suggests that "throughout the gaseous body, as well as outside and inside the critical sphere, the various elements are altogether intrinsically mixed (granting that in the mixture the quantity of materials with greater specific gravity must grow with the depth)." It is suggested that in the whirls formed by the ascent and descent of heated gases, combined with the rotational velocity of the solar atmosphere, we get anomalous dispersion at the point where two or more of these whirls intersect and break each other; and the author goes on to propose "that the whole chromosphere, with all its prominences, is nothing but this system of waves and whirls made visible, within shorter or longer distances from the sun's edge, by anomalous dispersion of light coming from deeper layers."

Professor Julius also points out that this theory abolishes the necessity for supposing the immense velocities which Fenyi and others have observed in connection with solar prominences, because it suggests that there is not a transmission of material, but only successive appearances of the same phenomena at various heights. He likens this to the apparent velocity of the line of foam caused by water waves breaking on a coast which is inclined to their wave-fronts.

Glacial Phenomena in the North of England.—Professor Kendall has recently published a very interesting lecture on this subject, that was originally delivered at the January meeting of the Geological Society. He deals with the Cleveland Hills, and points out the evidence there existing of the former occurrence of a number of glacier lakes or "extra-morainic lakes," such as are produced whenever a glacier or ice-sheet advances against or across the general slope of a country and impounds the natural drainage. Evidence is given of such lakes of large and small dimensions in the vale of Pickering, in Glaisdale and Eskdale, in Harwood Dale and at Hackness—lakes that must have been formed when the ice occupied the vale of York and extended along the northern and eastern borders of the Cleveland area. The evidence is furnished by shore scarps, occasional lacustrine deltas with fan-like forms; by laminated lacustrine deposits, such as the warp clays of the vales of Pickering and York; by overflow channels, whence the impounded water escaped in gaps which trench the main watershed or sever spurs independent of the present natural drainage; and by crescentic valleys excavated in the face of a hill by water flowing round a lake of ice. The glacial deposits are fully considered from sections and from borings, some of which were carried out by Professor Kendall. The assemblages of boulders and rock fragments lead to the conclusion that three main ice-movements affected the area—a northern, from Scotland and Northumberland; a western, from Stainmoor Pass and the Tees valley; and an eastern, from the North Sea and Scandinavia. The general sequence which may be inferred from a study of the somewhat complicated phenomena is (1) the unobstructed passage of the Teesdale glacier to the coast; (2) the arrival of the Scandinavian ice; and (3) the invasion of the Scottish ice. The author finds no signs of the presence of the sea in the Cleveland area at any time during the glacial period.

The Spectrum of Nova Persei.—Professor Campbell and Mr. Wright subscribe a short note to the Lick Observatory *Bulletin* on the later spectrum of Nova Persei.

Spectrogams obtained throughout the autumn and winter, up to January 7, 1902, showed no appreciable difference from the immediately preceding ones—the fine dark H (calcium) line referred to in a previous notice still remaining visible. It was suggested that the corresponding K line did not appear because there was no light in the region of the spectrum for the calcium vapour to absorb; but this suggestion has been proved incorrect by the appearance of the K line on a negative obtained by Mr. Wright, which was given a very long exposure, with the intention of seeing whether this line did or did not exist in the Nova spectrum.

The writers suggest that it would now be an exceedingly interesting experiment to test the presence of the absorption lines of calcium, sodium, and other elements in the gaseous nebulæ, by giving exposures long enough to record their continuous spectra.

Characteristics of the Mont Pelée Eruptions.—Drs. Anderson and Flett visited the scene of the tragic eruptions, which, as the recent disturbance bears witness, are not yet finished, and an excellent summary of their observations appears in the issue of *Nature* for August 21, from which we quote the following account of the peculiarities of the eruptions:—"There can be no doubt that the eruption we witnessed was a counterpart of that which destroyed St. Pierre. The mechanism of these discharges is obscure, and many interesting problems are involved. But we are convinced that the glowing avalanche consisted of hot sand and gases—chiefly steam; and when we passed the hill in the *Wear* a few days later, we had, by the kindness of the captain, an excellent opportunity of making a close examination of the shore from the bridge of the steamboat. The south-west side of the hill, along the course of the Rivière Secte, was covered with a thin coating of freshly-fallen fine gray ashes, which appeared to be thickest in the stream valleys. The water of the rivers flowing down this side of the hill was steaming hot. This was undoubtedly the material emitted from the crater on the night of the eruption. There was no lava. We saw no explosion of combustible gases, and nothing like a sheet of flame. We were agreed that the scintillations in the cloud were ordinary lightnings, which shot from one part of its mass to another, and partly also struck the sea beneath.

"The most peculiar feature of these eruptions is the avalanche of incandescent sand, and the peat-black cloud which accompanies it. The preliminary stages of the eruption, which may occupy a few days or a few hours, consist of outbursts of steam, fine dust, and stones, and the discharge of the crater lakes as torrents of water or of mud. In them there is nothing unusual; but as soon as the throat of the crater is thoroughly cleared, and the climax of the eruption is reached, a mass of incandescent lava rises and wells over the lip of the crater in the form of an avalanche of red-hot dust. It is a lava blown to pieces by the expansion of the gases it contains. It rushes down the slopes of the hill, carrying with it a terrific blast which mows down everything in its path. The mixture of dust and gas behaves in many ways like a fluid. The exact chemical composition of these gases remains unsettled. They apparently consist principally of steam and sulphurous acid. There are many reasons which make it unlikely that they contain much oxygen, and they do not support respiration."

Discovery of a New Comet.—Mr. C. D. Perrine, Assistant Astronomer at the Lick Observatory, Mount Hamilton, California, reports his discovery of a telescopic comet on September 1. The comet, which was of the ninth magnitude, was situated in the constellation Perseus, its R. A. and N. Decl. at 15 minutes after noon, Greenwich time, being: R. A., 3 hours

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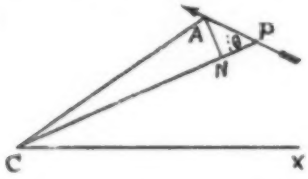
ANGULAR VELOCITY.—The angular speed, or angular velocity, of a point which is moving in any way in a plane about a fixed point in the same plane is the rate of rotation of the straight line joining the moving to the fixed point. When a rigid body rotates about a fixed axis—such as, say, a door rotating about the line joining the hinges—it is evident that the lines joining the several points of the body to the centres of the circles in which the points respectively move, all turn through the same angle in the same time; hence at any given instant the *angular velocity* is the same for all points of the body, and when uniform is measured by the number of units of angle turned through in unit of time. The unit angle is the *radian*, the unit of time one second, so that angular velocity is usually expressed as radians per second.

This section of the subject is so important that it may be desirable to obtain the necessary formulæ in a more general manner. Thus the angular velocity of a point P, which moves in any manner relative to a fixed point C, is the rate of change of the angle PCX, where CX is a line fixed in direction and passing through C.

Let P be moving with velocity v in a direction PA, making an angle θ with CP, and let A be the position of P after a short



interval of time δt. Join A to C, and draw AN perpendicular to CP, and intersecting CP in N. Then PN and NA are the two rectangular components of PA.

$$\therefore \text{NA} = \text{AP} \sin\theta = v\,\delta t \sin\theta.$$

$$\text{Also the sine of the angle PCA} = \frac{\text{NA}}{\text{CA}} = \frac{v\,\delta t \sin\theta}{\text{CA}}.$$

When δt is a small quantity, CA is approximately equal to CP, the difference between the two becoming less and less as the interval of time is diminished.

The angular velocity of P is therefore represented by

$$\frac{v \sin\theta}{\text{CP}} \quad \ldots\ldots\ldots \quad (1)$$

The point P may move along any plane curve, the direction of motion at any point being the tangent to the curve at the point. As a particular but very important case when the plane curve is a circle centre C, the direction of motion at any point P is the tangent at the point; hence the angle APC is a right angle, and as $\sin 90° = 1$, we obtain from (1) $\frac{v}{\text{CP}}$. Let r denote the length CP, and ω the angular velocity of P. Then from (1) we have $\omega = \frac{v}{r}$, or $v = \omega r$. . . . . (2)

(The fundamental relation given by (2) should be clearly made out and committed to memory.)

The distance moved through in one revolution by any point in a rotating body, at a distance r from the centre, is $2\pi r$, and the angle described is 2π. Hence, if n revolutions are made per second, $v = 2\pi r n$, and $\omega = 2\pi n$.

Question 1. Define angular velocity. Draw a straight line, and mark on it four points in order A, B, C, D. Let AB, BC, CD, be respectively 2 ft., 1 ft., and 3 ft. Suppose a particle to be at C, moving at right angles to AD at the rate of 4 feet a second, find its angular velocity with reference to A, B, and D respectively.

In what respects does the angular velocity with reference to A differ from the angular velocity with reference to D?

(1894.)

Solution. The distance of the point C from A is 3 ft. Hence from (2) $\omega = 4 \div 3 = \frac{4}{3}$ radians. The distance from B is 1 ft., and angular velocity with reference to B is $4 \div 1 = 4$ radians per second. The distance from C to D is the same as from C to A, but the rotation is in a negative direction; hence the angular velocity with reference to D is $-\frac{4}{3}$ radians per second.

Question 2. What is the numerical value of the angular velocity of a body which turns uniformly round a fixed axis twenty-five times a minute? (1893.)

Answer. $\frac{5}{6}$ radians per second.

Question 3. Define the angular velocity of a moving point with respect to a fixed point. Under what circumstances will the angular velocity of the moving point be equal to its linear velocity divided by its distance? (1896.)

Answer. When line of motion is perpendicular to line joining moving to fixed point.

Question 4. If a particle be moving with velocity v in a plane, under what circumstances is the formula $v = r\omega$ true, r being the distance from, and v the angular velocity about, a fixed point in the plane? (1898.)

Question 5. Investigate the relation between the linear velocity of a moving point and its angular velocity about a given fixed point in the general case. (1901.)

Question 6. Define angular velocity, and explain how it is measured. A carriage with 5-foot wheels is moving at the rate of 10 miles per hour; find the angular velocity of the wheel and the linear velocities of the points which at any instant are at the extremities of the horizontal and vertical diameters.

Answer. $\frac{88}{15}$ radians per second. (1901.)

UNIFORM CIRCULAR MOTION.—A point which is moving in a circle of radius r, with uniform speed v, will describe equal arcs in equal times; therefore the angular velocity of the point will be uniform. If T is the time in seconds of a revolution, then $\omega = v \div r = 2\pi \div \text{T}$.

The attention of the reader has been already drawn to the use of the word *particle*, and that it is found convenient to use the term to denote any body in which only the motion of one point (that is, its centre of gravity) is considered; when this is clearly made out, many common mistakes may be avoided. Thus, in the case of a rotating body—such as a rotating disc—the line passing through the centre of gravity may be the axis of rotation, and is therefore at rest; hence the formula for kinetic energy in the form presented ($\frac{1}{2}mv^2$) is not applicable. There are, of course, exceptions to such a rule, as in the case of what is called a fly-wheel, which usually consists of a comparatively heavy rim (the cross-section of which is some simple geometrical figure, such as a circle, a square, or a rectangle) connected by suitable arms to the centre. The position of the centre of gravity of such a cross-section, and its distance r from the axis (which may be simply the arithmetical mean of the internal and external radii), are known.

The space described in one turn is $2\pi r$, and the speed v, when n revolutions are made per second, is given by $v = 2\pi n r$. Hence we may substitute this value, and we obtain

$$\text{K. E.} = \tfrac{1}{2}mv^2 = \tfrac{1}{2}m \times 4 \times \pi^2 \times r^2 n^2$$
$$= \tfrac{1}{2}m\omega^2 r^2 = \tfrac{1}{2}m \times 4\pi^2 r^2 \div \text{T}^2.$$

Ex. 1. A fly-wheel weighs 10000 lbs., and is of such a size that the matter composing it may be treated as if concentrated on the circumference of a circle 12 feet in radius; what is its kinetic energy when moving at the rate of 15 revolutions a minute ($g = 32$)? How many revolutions would it make before coming to rest if it moved against a friction of 400 lbs. exerted on the circumference of an axle 1 foot diameter? (1896.)

$$\text{K. E.} = \tfrac{1}{2} \times 10000 \times 4 \times \pi^2 \times \left(\frac{15}{60}\right)^2 \times 12^2$$
$$= 450000\pi^2 \text{ foot-poundals},$$
$$\text{and } 450000\pi^2 \div 32 = 55561{\cdot}2 \text{ foot-pounds}.$$

The resistance moves through a distance $1 \times 3{\cdot}1416$; hence if n denote the number of turns,

$$\therefore n = \frac{55561{\cdot}2}{3{\cdot}1416 \times 400} = 44{\cdot}2 \text{ turns}.$$

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Dudoch.—The latent heat of steam is 537. Calculate what would be the minimum volume of a "producer gas" having the volumetric composition of nitrogen 40 per cent., carbon monoxide 40 per cent., and hydrogen 20 per cent., which would have to be burnt in order to evaporate 10 kilograms of water at 100° C.

Heat of formation of CO_2 = 97,000 calories.
" " CO = 29,000 "
" " H_2O = 57,200 "

When such a mixed gas as the one described is burned, a certain amount of heat is produced; but the whole of this cannot be utilised, as some of it is used in heating the products of combustion, and some in heating up the nitrogen. No data, however, are given for calculating the heat thus used up, and it is evidently intended that allowance should not be made for this in the calculation. Assuming that the gas is to be measured under a pressure of 760 mm. of mercury, and at a temperature of 0° C., the following will be the solution:—

The heat generated by burning 12 grams of carbon to carbon monoxide is 29,000 calories, and the heat generated by burning 12 grams of carbon to carbon dioxide is 97,000 calories; hence the heat generated by burning 28 grams of carbon monoxide (that is, the amount produced by burning 12 grams of carbon) to carbon dioxide is 97,000 – 29,000 calories—that is, 68,000 calories. The heat generated by burning 2 grams of hydrogen is 57,200 calories.

If we take 100 litres of the producer gas, this will contain 40 litres of nitrogen, which will be chemically unchanged; 40 litres of carbon monoxide, which will burn to carbon dioxide; and 20 litres of hydrogen, which will burn to water.

The weight of one litre of hydrogen at N.T.P. is ·0896 grams, and the weight of 20 litres therefore 1·792 grams.

The heat generated by burning 20 litres of hydrogen will therefore be $\frac{57200 \times 1{\cdot}792}{2}$ calories = $28600 \times 1{\cdot}792$ calories.

The density of carbon monoxide as compared with hydrogen is $\frac{12+16}{2} = 14$. The weight of 40 litres of carbon monoxide at N.T.P. is therefore $\cdot0896 \times 14 \times 40$ grams. The heat generated by the combustion of this weight of carbon monoxide is

$$\frac{68000 \times \cdot0896 \times 14 \times 40}{28} = 68000 \times 1{\cdot}792 \text{ calories.}$$

The heat generated by the combustion of 20 litres of hydrogen and 40 litres of carbon monoxide—that is, 100 litres of the producer gas (the nitrogen does not burn)—is

$(28600 + 68000) \times 1{\cdot}792$ calories, or $96600 \times 1{\cdot}792$ calories.

The heat required to evaporate 10 kilograms of water at 100° C. is 537×10000 calories; therefore the volume of producer gas required is

$$\frac{5370000 \times 100}{96600 \times 1{\cdot}792} \text{ litres} = 3102{\cdot}123 \ldots \text{ litres.}$$

Geographer.—Since the surface of the earth is a sphere, it is evident that in constructing a map of any portion of the earth's surface, the map must be made on a spherical surface if it is to truly represent on any *uniform* scale the actual distances on the area delineated. This is, however, not usually convenient, and therefore attempts have been made to construct maps on plane surfaces in such a way as to introduce as little error as possible. One of the methods used is the method of conical projection.

Fig. 1 represents the orthographic projection of a sphere in a plane passing through the centre. Suppose it is required to

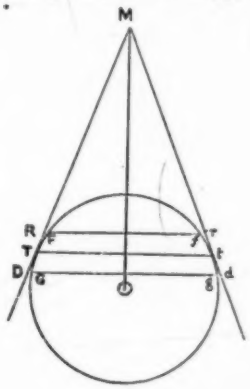

FIG. 1.

construct a map of a country lying between F and G, take the parallel of latitude in the middle of the country, and construct a cone touching the sphere along that parallel. This is represented in our orthographic projection by T*t*M. Now take two other parallels, F*f* and G*g*, equidistant from T*t*, and such that the country lies between them. Make TR = TF, TD = TG, $tr = tf$, and $td = tg$. The surface of revolution produced by DR revolving round OM would very nearly coincide with that generated by GF, especially if GF is small. Now mark the cone at the intersections of its surface with the meridian planes of the sphere, cut the cone along one of these lines, and open out so as to get a plane surface. By doing so we get an *approximately* true representation, R*rd*D, on a plane surface of that portion of the sphere contained between the parallels F*f* and G*g*. (See Fig. 2.) The meridians are represented by straight lines through the common centre M of the circles representing the parallels of latitude. Suppose the country required to be mapped out extends α degrees north of T*t*, and α degrees south of T*t*, and extends through β degrees east and west of the central meridian, divide RD into 2α divisions, and draw through the points arcs of circles with M as centre; divide the required portion of T*t* into 2β divisions, and draw the meridian lines through M and these points, MV, MW, etc. (Fig. 2.)

The defect of this method of projection consists in the fact that the lengths of the parallels to the north and south of the

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map are exaggerated, and this is especially so if the country has a great extent of latitude.

A modification of this method, known by the name of "The Projection de Bonne," was used for the Ordnance Survey map

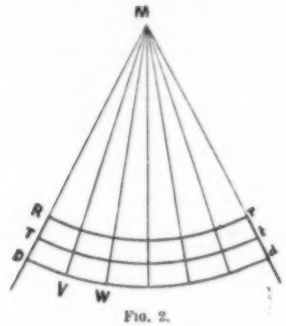


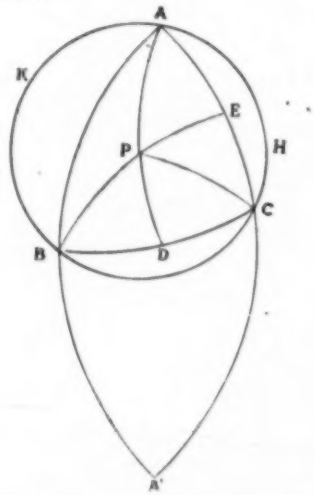
Fig. 2.

of Scotland, and is used for large scale maps in some atlases. The modification is as follows:—Divide the central meridian into degrees (or equal numbers of degrees), and through the points draw parallels, and then mark off on each parallel the true lengths of the degrees. The meridians thus become curved. The objection to this method is that in maps representing large areas the intersections of the meridians and parallels become very oblique, as may be seen in the maps of Asia in many atlases.

Another modification of the conical projection, due to Gerard Mercator, is sometimes used. It consists in describing a cone which has its apex on the axis of revolution as before, but which cuts the sphere at two parallels midway between the central parallel of the country and the extreme parallels. By adopting this method a portion of the error is corrected: part of the error is thrown on the central parallel, which becomes too short, the parallels to the north and south of the map are a little too long, but the two parallels where the cone intersects the sphere are of their true length, and there is not the same amount of distortion in the map as a whole.

[Reply to your query under pseudonym *Debutant* was posted to you direct, as we are unable to reply in our columns, owing to want of space to reproduce section of map. This, however, has been returned to us as "unknown" at the address supplied. Kindly let us know where we should send reply.]

Bike.—Spherical triangles on the same base are inscribed in the same circle; show that the complementary triangles on the other side of the base are all of the same area. What is the locus of their vertices?



Let BHK be the given circle and BC the given base, and let ABC be any spherical triangle inscribed in the circle BCHK. Let AB, AC produced intersect in A'. Then, if B_1 denote the angle A'BC, and C_1 the angle A'CB, we have, from the well-known expression for the area of a spherical triangle,

$$\text{area of triangle A'BC} = (A' + B_1 + C_1 - \pi)r^2.$$

But $B_1 = \pi - B$, $C_1 = \pi - C$, and $A' = A$;

$$\therefore \text{area of triangle A'BC} = \{\pi - (B + C - A)\}r^2 \quad . \quad . \quad . \quad (1).$$

Bisect BC in D, CA in E, and from D and E draw arcs at right angles to BC, CA respectively, and let P be their point of intersection. Draw the arcs PA, PB, PC. Then because in the triangles BDP, CDP we have BD, DP equal to CD, DP, each to each, and the angle BDP is equal to the angle CDP, each being a right angle, therefore the arc PB is equal to the arc PC. Similarly, it may be shown that the arc PC is equal to the arc PA.

Therefore PA = PB = PC. Hence P is the pole of the circle BHK, in which the triangle ABC has been inscribed. Also, the angle PBA is equal to the angle PAB, the angle PCB to the angle PBC, and the angle PCA to the angle PAC; hence $PCB + A = \frac{1}{2}(A + B + C)$, and therefore $PCB = \frac{1}{2}(B + C - A)$.

Again, from the right-angled triangle PCD we have—

$$\tan CD = \tan PC \cos PCD.$$

$$\therefore \tan \tfrac{1}{2}BC = \tan PC \cos \tfrac{1}{2}(B + C - A) \quad . \quad . \quad . \quad . \quad . \quad (2).$$

Now, by the data of the question, BC and PC are both constants, therefore (B + C − A) is a constant. Then from (1) it follows that the area of the triangle BCA' is constant.

Again, since BHK is a *given* circle, therefore the arc PC is given in magnitude, and BC is given; therefore by (2) the value of (B + C − A) can be determined. Then from (1) the area of the triangle A'BC can be found.

We have then to find the locus of the vertex A' of the spherical triangle A'BC of given base and area. This, in any treatise on spherical trigonometry, is shown to be a circle.

Black Bishop.—Show that if a circle touches an ellipse at P, and cuts it at Q and R, then PQ, PR, and the axis of the ellipse form an isosceles triangle.

(*Tutorial Co-ordinate Geometry*, Part II.)

Let P'PQ'R' be any circle passing through P and cutting the ellipse also in P', Q', R'. Let E be the intersection of the chords P'Q', PR'. Then, since the rectangles under the segments of two chords of a circle which intersect within the circle are equal, we have P'E . EQ' = PE . ER'.

But in an ellipse, the rectangles under the segments of two chords which intersect are to each other as the squares of the diameters parallel to those chords. Hence the diameters of the ellipse which are parallel to the chords P'Q', PR' are equal, and are therefore equally inclined to the axis. It follows, then, that the chords P'Q', PR' are also equally inclined to the axis.

Since the above result holds for any circle passing through P, it holds for the particular case in which P' coincides with P—that is, for the case in which the circle touches the ellipse at P, and cuts it at two points Q and R. P'Q' then coincides with PQ, and PR' with PR. Hence PQ, PR, and the axis of the ellipse form an isosceles triangle.

Sarumo.—Prove that the smallest radius on which a motor car can turn without upsetting, at a velocity of v feet per second, is $2\frac{v^2}{g} \cdot \frac{h}{a}$ feet, where h is the height of the centre of gravity above ground, and a is the width of track of the wheels.

(B.Sc., 1901.)

Let O be the centre of the horizontal circle which G the centre of gravity describes during the turning, and let the length of the radius GO be denoted by r. Then the centripetal force acting at the centre of gravity G has GO for its direction, and its amount is given by the expression $m\frac{v^2}{r}$, where m is the mass of the car.

When the car is just on the point of upsetting, the only forces acting upon it are (1) the centripetal force $m\frac{v^2}{r}$ along the horizontal GO; (2) the weight $m \cdot g$ acting downwards along the vertical through G; and (3) the reaction of the ground at the *inner* track. Taking moments about the inner track, we have

$$m\frac{v^2}{r} \cdot h = mg \cdot \frac{a}{2}.$$

Hence we have

$$r = 2\frac{v^2}{g} \cdot \frac{h}{a} \text{ feet.}$$

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Carrett.—Forces act upon a rigid lamina in its own plane, and along the directions of the sides BC, CA, AB of a triangle, and are in magnitude proportional to these sides. Determine the smallest number of other forces that must act on the lamina to produce equilibrium. If upon this lamina there be drawn a rectangle ABCD, and entirely within this rectangle another rectangle EFGH, express geometrically the single equivalent of forces represented in magnitude, direction, and position by AB, BF, EF, EA, CD, DH, GH, GC—E, F, G, H being near to A, B, C, D respectively. (Cambridge Senior.)

Draw the triangle ABC, and let BC, CA, AB represent in magnitude and direction the three forces which, in the first part of question, are supposed to act on the rigid lamina. Produce BC to D, making CD equal to BC. Complete the parallelogram ACDE. Then the diagonal CE will represent in magnitude and direction the resultant of the two given forces represented by BC, CA. Since DE is parallel to CA, therefore the angle CDE is equal to the angle BCA, also CD is equal to BC by construction, and DE is equal to CA—these being opposite sides of a parallelogram; hence CE is equal to AB, and the angle ECD to the angle ABC (Euclid, I. 4). Therefore CE is parallel to AB. From this it follows that the three forces, BC, CA, AB, are equivalent to the two equal and opposite parallel forces CE and AB. Hence the given forces are equivalent to a *couple* whose moment is represented by twice the area of the triangle ABC. We shall therefore require at least two forces to produce equilibrium.

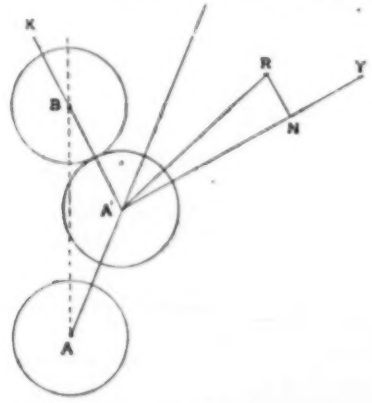
Drawing the figure for the second part of the question, we see that the given forces are equivalent to the forces represented by the sides taken in order of the quadrilaterals ABFE, CDHG, together with the forces represented in magnitude and direction by twice EF and twice GH respectively.

Now, it is an easy deduction from the first part of the question that the forces represented by the sides taken in order of the quadrilateral ABCE are equivalent to a couple whose moment is represented by twice the area of that quadrilateral. Similarly the forces represented by the sides taken in order of the quadrilateral CDHG are equivalent to a couple whose moment is represented by twice the area of that quadrilateral.

Again, the forces represented by twice EF and twice GH respectively, being equal, opposite, and parallel, are equivalent to the couple whose moment is represented by twice the area of the rectangle EFGH. It is obvious that these three are *like* couples.

Hence the single equivalent of the given forces is a couple whose moment is represented by twice the sum of the areas of the quadrilaterals ABFE, CDHG, and EFGH.

Caliga.—Prove that, in order to produce the greatest deviation in the direction of a smooth billiard ball of diameter a by impact on another equal ball at rest, the former must be projected in a direction making an angle $\sin^{-1}\frac{a}{c}\sqrt{\frac{1-e}{3-e}}$ with the line (of length c) joining the two centres, e being the coefficient of restitution. (Cambridge Mathematical Tripos, 1873.)



Let A, B denote the positions of the centres of the balls to begin with, and let the ball whose centre is at A be projected with velocity V in the direction AA′, A′ being the position of its centre on impact with the ball whose centre is at B. Resolve the velocity V along A′B and along A′Y at right angles to A′B. Then if θ denote the supplement of the angle AA′B, the resolved part of the velocity along A′B will be V cos θ, and the resolved part along A′Y will be V sin θ. Again, since the masses of the balls are equal, from the fundamental equations we have—

$$v' - v = e\,\mathrm{V}\cos\theta,$$
$$v' + v = \mathrm{V}\cos\theta.$$
$$\therefore\ v = \frac{1-e}{2}\,\mathrm{V}\cos\theta.$$

Hence, after impact, the resultant velocity of the ball whose centre is at A′ when impact occurs will be due to two components—namely, $\frac{1-e}{2}$ V cos θ along A′B, and V sin θ along A′Y. Let A′R represent this resultant velocity in magnitude and direction. Draw RN perpendicular to A′Y. Then if β denote the angle NA′R, we have—

$$\tan\beta = \frac{\mathrm{RN}}{\mathrm{NA'}} = \frac{\frac{1-e}{2}\,\mathrm{V}\cos\theta}{\mathrm{V}\sin\theta} = \frac{1-e}{2}\cot\theta.$$

Again, if we represent by γ the angle between RA′ and A′A produced, we have $\gamma = \frac{\pi}{2} - (\theta + \beta)$, and therefore

$$\cot\gamma = \tan(\theta+\beta) = \frac{\tan\theta + \tan\beta}{1 - \tan\theta\tan\beta}.$$
$$\therefore\ \cot\gamma = \frac{\tan\theta + \frac{1-e}{2}\cot\theta}{1 - \frac{1-e}{2}\tan\theta\cot\theta}.$$

Hence, representing cot γ by y and tan θ by x, we have—

$$y = \frac{x + \frac{1-e}{2}\cdot\frac{1}{x}}{1 - \frac{1-e}{2}} = \frac{2x^2 + 1 - e}{(1+e)x}.$$
$$\therefore\ \frac{dy}{dx} = \frac{2(1+e)x\,.\,2x - (2x^2+1-e)(1+e)}{(1+e)^2x^2} = \frac{2(1+e)x^2 - (1-e^2)}{(1+e)^2x^2},$$
$$\text{and}\ \frac{d^2y}{dx^2} = \frac{4(1+e)^2x^2 - 2\{2(1+e)^2x^2 - (1-e^2)\}(1+e)^2x}{(1+e)^4x^4}.$$

Hence y is a *minimum* when $x = \sqrt{\frac{1-e}{2}}$.

Therefore cot γ is a minimum when $\tan\theta = \sqrt{\frac{1-e}{2}}$;

that is, γ is a *maximum* when $\tan\theta = \sqrt{\frac{1-e}{2}}$.

$$\sin\theta = \frac{\tan\theta}{\sqrt{(1+\tan^2\theta)}} = \frac{\sqrt{\frac{1-e}{2}}}{\sqrt{\left(1+\frac{1-e}{2}\right)}} = \sqrt{\frac{1-e}{3-e}}.$$

Hence γ, the angle of deviation, is a maximum when

$$\sin\theta = \sqrt{\frac{1-e}{3-e}}.$$

From the triangle AA′B we have, if we denote the angle A′AB by α,

$$\frac{\sin\alpha}{\sin\theta} = \frac{\mathrm{A'B}}{\mathrm{AB}} = \frac{a}{c}.$$
$$\therefore\ \sin\alpha = \frac{a}{c}\sin\theta = \frac{a}{c}\sqrt{\frac{1-e}{3-e}}.$$
$$\therefore\ \alpha = \sin^{-1}\frac{a}{c}\sqrt{\frac{1-e}{3-e}}.$$

Scamp.—The difference of two numbers is 117, and their L.C.M. 1456. Find the numbers.
(Christian and Collar's *Arithmetic.*)

The factors of the L.C.M. are 7, 13, and 2^4.
The factors of the difference are 13 and 3^2.
Any common factor of two numbers is a factor of their difference. Hence, since neither 7 nor 2 is a factor of the difference, it follows that 13 is the only common factor of the two numbers. Therefore one of the numbers must be (13×7), or 91; and the other (13×2^4), or 208.

Poppy.—A train, 97 yards long, travelling at the rate of 45 miles an hour, overtakes a slow train, 123 yards long, travelling

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in the same direction on a second line of rails at the rate of 30 miles an hour. What time will elapse from the first overtaking of the slow by the fast train to the moment that the latter has passed the former? (Evan's *Arithmetic*.)

By the question, it is evident that the fast train gains 15 miles an hour on the slow.

Fifteen miles an hour $= \frac{15 \times 1760 \times 3}{60 \times 60}$ feet per second

$= 22$ feet per second.

The total length of the two trains is (123 + 97) yards, or 660 feet.

The fast train gains 22 feet on the slow in one second; hence it will gain the 660 feet in 30 seconds.

T. Coulthard.—Prove that the number of ways in which p positive and n negative signs may be placed in a row, so that no two negative signs shall be together, is $(p+1)C_n$. (Hall and Knight's *Higher Algebra*.)

Let the places occupied by the p positive signs be marked in a row as in the diagram.

\+ + + + + + + +

Then it is obvious that, including the spaces at the ends of the row, there are $p+1$ spaces, in any one of which not more than one negative sign may be written, so as to satisfy the conditions of the question. The number of ways in which we may thus insert n negative signs is clearly equal to the number of combinations of the $p+1$ spaces which can be made, taking n spaces together. *Q.E.D.*

Civis.—A particle moves under the action of gravity on a smooth paraboloid whose axis is vertical, vertex downwards, and latus rectum $4a$. If the particle be projected along the surface of the horizontal plane through the focus with a velocity $\sqrt{(2nag)}$, prove that the initial radius of curvature ρ of the path and the angle θ, which the radius of curvature makes with the axis, are given by—

$$\sqrt{(n^2+1)}\rho = 2na\sqrt{2}$$
$$(1-n)\tan\theta = 1+n.$$

Equation of paraboloid is—

$$x^2 + y^2 = 4az \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Equation of conservation of energy—

$$\dot{x}^2 + \dot{y}^2 + \dot{z}^2 + 2g = 2ag(1+n) \quad . \quad . \quad . \quad (2)$$

Equation of conservation of angular momentum about oz—

$$x\dot{y} - y\dot{x} = -\sqrt{8a^3ng} \quad . \quad . \quad . \quad . \quad . \quad (3)$$

When $t = o$ $\begin{cases} x = o & \dot{x} = \sqrt{(2nag)} \\ y = 2a & \dot{y} = o \\ z = a & \dot{z} = o \end{cases}$

From (1) $\qquad z = \frac{x^2+y^2}{4a}$.

Differentiating, we obtain $\dot{z} = \frac{x\dot{x}+y\dot{y}}{2a}$,

and $\qquad \ddot{z} = \frac{\dot{x}^2+\dot{y}^2+x\ddot{x}+y\ddot{y}}{2a} \quad . \quad . \quad . \quad . \quad . \quad (4)$

From (3), by differentiation—

$$\dot{x}\dot{y} + x\ddot{y} - \dot{x}\dot{y} - y\ddot{x} = o.$$
$$\therefore x\ddot{y} = y\ddot{x} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

From (4) and (5)—

$$2a\ddot{z} = \dot{x}^2 + \dot{y}^2 + \frac{\ddot{y}}{y}(x^2+y^2) \quad . \quad . \quad . \quad (6)$$

Differentiating (2), and using (5)—

$$x\ddot{x} + y\ddot{y} + \dot{z}\ddot{z} + g\dot{z} = o \quad . \quad . \quad . \quad . \quad (6a)$$
$$\frac{\ddot{y}}{y}(x\dot{x} + y\dot{y}) + \dot{z}\ddot{z} + g\dot{z} = o;$$

or $\qquad \frac{\ddot{y}}{y}2a\dot{z} + \dot{z}\ddot{z} + g\dot{z} = o.$

$$\therefore \frac{\ddot{y}}{y} = -\frac{g+\ddot{z}}{2a}.$$

Substituting this value in (6)—

$$2a\ddot{z} = \dot{x}^2 + \dot{y}^2 - \frac{g+\ddot{z}}{2a}(x^2+y^2) \quad . \quad . \quad . \quad (7)$$

Putting in the above values for $t = o$ or $z = a$—

$$\ddot{z} = \frac{g(n-1)}{2}.$$

Using (6a) and (5),

$$\frac{\dot{x}x\ddot{y}}{y} + \dot{y}\ddot{y} + \dot{z}\ddot{z} + g\dot{z} = o,$$

we get $\ddot{y} = -\frac{y(\dot{z}\ddot{z}+g\dot{z})}{(x\dot{x}+y\dot{y})} = -\frac{y(\dot{z}\ddot{z}+g\dot{z})}{2a\dot{z}} = -\frac{y(\ddot{z}+g)}{2a}$.

But $\qquad \ddot{z} = \frac{g(n-1)}{2}$.

$$\therefore \ddot{y} = -\frac{2a\{g(n-1)+2g\}}{2a\times 2} = \frac{g(n+1)}{2}.$$

Similarly by (6a) and (5), and eliminating $\ddot{y}$ instead of $\ddot{x}$, it will be found that $\ddot{x} = o$.

$$\therefore \text{When } t = o \begin{cases} \ddot{x} = o \\ \ddot{y} = -\frac{g}{2}(n+1) \\ \ddot{z} = \frac{g}{2}(n-1) \end{cases}.$$

At the end of a time δt, if very small, the velocity in the z direction will be $\ddot{z}\delta t$, and in the y direction $\ddot{y}\delta t$, and in the z direction still $\dot{x}$. The deviation will therefore be of amount

$$\int_t^{\tan^{-1}} \frac{\sqrt{(\ddot{y}dt)^2+(\ddot{z}dt)^2}}{\dot{x}},$$

and is in the yoz plane.

But the distance moved over in this same time is $\dot{x}dt$, and therefore, as the radius is equal to $\frac{\text{arc}}{\text{angle}}$,

$$\rho = \frac{\dot{x}dt}{\int_t^{\tan^{-1}} \frac{\sqrt{(\ddot{y}dt)^2+(\ddot{z}dt)^2}}{\dot{x}}}$$
$$t = o$$
$$= \frac{x^2}{\sqrt{\ddot{y}^2+\ddot{z}^2}}$$
$$= \frac{2nag}{\frac{g}{2}\sqrt{(n-1)^2+(n+1)^2}}.$$
$$\therefore \rho\sqrt{n^2+1} = 2\sqrt{2na}.$$

The deviation being in the yoz plane, and the radius of curvature at right angles to the path, its inclination to oz will be $\tan^{-1}\frac{\ddot{y}}{\ddot{z}}$; or if θ is the angle,

$$\tan\theta = \frac{\ddot{y}}{\ddot{z}} = -\frac{n+1}{n-1}.$$
$$\therefore (1-n)\tan\theta = 1+n.$$

Ignoramus.—Your surmise is correct; the form you quote is indeterminate when $n = \infty$. You will find this form fully discussed in most modern works on the differential calculus. (See Williamson's *Differential Calculus*, § 93, Example 4.)

Doubtful.—In order to determine the melting point of an easily oxidisable substance, such as sodium or potassium, it is best to conduct the experiment *in vacuo*. The sodium may be placed in a large test-tube, which is quickly closed by means of a well-fitting cork, and then exhausted by means of a tube just passing through the cork. A thermometer also passes through the cork, its bulb being near the bottom of the test-tube. The metal may now be melted by immersing the test-tube in an oil bath; in the case of sodium, which melts at 95·6°, a water bath may be used. When the metal is thoroughly melted, the bath may be allowed to cool slowly. In general, the metal will not commence to solidify at its melting point; but if it is allowed to cool beyond this temperature, stirring will cause solidification to commence, and the temperature rises to the melting point, which can be observed by the aid of the thermometer. Compare Beckman's Melting-Point Method (Edser's *Heat for Advanced Students*, p. 167).

Another method would be to enclose a small angular fragment of the metal in a narrow tube which is quickly exhausted, and then to heat the tube in a bath, noting the temperature of the latter when the metal begins to melt; the fragment of metal will lose its angular form at the instant of melting.

Held over till next month: *Dorris, Fragselig, J. Morris.*

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RULES.

1. **All translations should be posted not later than October 8,** and addressed:—*Prize Editor*, Office of THE PRACTICAL TEACHER, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should adopt a pseudonym, and send name and address written on a separate piece of paper.
4. No competitor may take the prize offered more than once in three months.

FRENCH PRIZE COMPETITION.

A Prize of One Guinea will be given for the best translation into English of the following extract:—

Le dîner! moment intéressant et solennel pour nos grands-pères comme aussi, j'en ai peur, pour leurs petits-fils! Le Français a toujours mêlé la sociabilité et la vanité à la gastronomie. Il a la prétention de dire des choses exquises en mangeant des choses délicieuses. Le véritable gourmet ne serait-il pas celui qui mange seul et ne veut aucun témoin à ses émotions, à ses méditations? Comme l'amoureux, il veut la solitude du tête-à-tête, et, comme le religieux, le silence de la cellule. Ce drame gastronomique du dîner qui a, comme les autres drames, ses préparations, ses phases, sa péripétie et son dénouement, Rowlandson l'a déroulé devant nous avec la puissance et la sobriété d'un maître. Comme Hogarth, avec son crayon, racontait l'histoire d'une âme, il a raconté l'histoire d'une digestion. Le drame a trois actes: avant, pendant, après. C'est la même figure, les mêmes traits que nous voyons successivement s'allonger, se contracter, s'épanouir. D'abord l'attente inquiète, presque douloureuse, éclairée pourtant par le rayonnement du plaisir espéré. Puis le sérieux—l'attention exclusive et profonde, l'absorption de l'être dans l'auguste fonction qui s'accomplit. On comprend la vérité de cette parole: "L'homme ordinaire se nourrit, seul le gourmand dîne." Ensuite vient le recueillement, l'extase, le Nirvâna. Renversé en arrière, la paupière mi-close, entouré de visions heureuses qui flottent dans l'atmosphère chargée de subtils parfums, le dîneur repasse ses sensations, dîne une seconde fois par la pensée. C'est l'heure de la poésie, l'heure de l'idéal.

From "La Caricature en Angleterre," by
AUGUSTIN FILON.

RESULT OF THE AUGUST COMPETITION.

The prize is awarded to "Aiphos," the pseudonym of Miss M. S. Baker, care of Colonel Blake, Tillmouth Park, Cornhill-on-Tweed.

First Class.—Dewhurst, Zimena, Chemineau, Oakover, Thrums, Botanist, Devant, A 'Varsity Girl, Mathetes, Balbus, Omicron, Jac, Paterfamilias, L'anglais, Maîtresse, Fingal, Wessex, La Printanière, Caen dhuv dheelish, X., Feste, Hilaris, Clematis, Marquise, Macaulay, Kerboga, Kettering, Bulldog, Débutante, Lundi, Elf, Ambrosia, Marvenne, Ruffle, Chiffon, Treflawnydd, Awa Maru, Darling, Yllop, Verdant, Jeanie Deans, Briarcroft, Eurydice, Undine, Mist, Thornton, Timor Domini, Ruth, Eureka, Ephesian, Mai, Calder, Hopeful.

Second Class.—M.H., Nisa, Jessamine, Rajah, Srnri, A.S.W., Dox Sorley, A.M.S., Ben Lomond, Katter, H.A.D., Portia, Dolly, A daughter of Erin, Le travailleur, Elva, Peggy, La fin, June, M.K.P., Hovan, Wainstalls, Agricola, Doreen, Electricity, Boccaccio, Atalanta, Dynevorian, Enid, Perplexed, Les amis, Southport, Gert, Yvonne, Pompey, A.M.D.G., Money-spider, Tamar, Kew, Hood, Friar Mere, Hermia, Eve Effingham, Florothy, Snowdrop.

Third Class.—Rita, Brunswick, Babs, Sweet William, Milan, White Heather, Penybont-ar-Ogwy, Celandine, Glenscobin, Loose Hair.

Disqualified.—Rule 3: Marly.

Report.

The average merit of the papers sent in is rather disappointing. No one sent in a perfectly accurate translation, and not many translations possess literary merit. Too many yet fail to take a survey of the piece as a whole and get its general drift before commencing to write a translation. Very many rendered *conseil, critique, concours, réconfort* partly by abstract and partly by common nouns. *Pour son propre compte* = of her own, for her own part, and *ignorer* is "to be ignorant of." Very many missed the relative force of *y* in *s'y associe*. It refers, of course, to *volontés*.

Prize Translation.

A Frenchman is obliged first of all to exhaust part of his energy in winning over to his plans his wife and elder sons, in conquering the ever-recurring opposition he meets with each evening at his own fireside. The ordinary Frenchwoman is clear-minded, and has intelligence and courage of her own. Her husband finds a wise counsellor in her; sometimes she gives him indifferent criticism, often intelligent co-operation, but rarely the moral relief of full agreement. More often than not he is discouraged, or perhaps time passes and the opportunity slips away from him. If in spite of all he perseveres, he does not feel to have behind him a sure retreat in the event of failure—a place where he can recover himself by the side of a companion who believes in him without inquiry, and who restores his confidence in himself. The firmness of his resolves, his sureness of hand, are sorely handicapped. An Englishman meets neither opposition nor resistance at home. His will is never disputed. His sons, when present, respect his decision, or, when absent, ignore it. His wife identifies herself with him. There is in such clearly established authority, in his perfect autonomy, in his great responsibility, the motive power of a strength, of a stability, of an energy by no means usual. The family life, which has broken the English child into discipline, which has accustomed him in early manhood to freedom and responsibility, trains him in his character as father and husband to take the initiative in everything, and to reign supreme in his home.

EDMÉ BOUTMY.

RESULT OF THE FOREIGN AND COLONIAL COMPETITION.

The prize is awarded to "Diogenes Junior," the pseudonym of Mr. Edward Hayes, Middle Brighton, Victoria, Australia.

First Class.—Lotino (Chile), Irénée (France), Tui (New Zealand), Wattle Blossom (Australia), Elderberry (New Zealand), Sans Dictionnaire (Cape Colony), Mathinna (Australia), St. George's (British Guiana), Pakeha (New Zealand).

Second Class.—Jippa Jappa (Jamaica), Guy (Barbadoes), Kodai (India).

Report.

The quality of the papers sent in is satisfactory, but we are disappointed at not receiving more. The number sent in is less than those received for the first competition. This competition is still in its experimental stage. We shall be glad to know if any of the arrangements made for it are open to criticism from the point of view of colonial and foreign subscribers.

Translation.

The bodily appearance of Ami towards his fortieth year recalled that of his father, only in smaller, and, so to speak, counterfeit dimensions. His ugly mouth with its thin lips and bad teeth, his pointed nose, his retreating chin adorned with a fawn-coloured "goatee," his twisted appearance, which procured for him his nickname of Barbouchet (*goat-bearded*), gave to his face and to his whole person a deceitful and quarrelsome expression. In his case the expression did not belie him: always quarrelling with his neighbours or his customers, Chanteuille junior was held to be a man difficult to get on with—greedy, rapacious, lying, and not very scrupulous in his methods of pushing his business. A well-conceived plan of education would, perhaps, have improved his disposition. But his father, while he saw clearly the state of the case, never understood by what means he would have been able to amend his son. He beat him to a jelly in his childhood: as the proverb has it, "Who truly loves, chastises thoroughly." Afterwards he held the reins very tight, without leaving his son any freedom of action. He would say, "When I am gone, you will do what you like; while I am alive, you must walk straight."

His greatest mistake was to refuse any kind of satisfaction to the imperious need which governed his son—the need of getting. Instead of holding him by that, he haggled with his son about the workman's wages which he paid to him, or about the insignificant share which he flung to him out of any profitable transaction.

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ALLMAN AND SON.

Preparatory Lessons in Chemistry. By Henry W. Hill. Mr. Hill's lessons are a compromise between the method of telling and the method of discovery, or heuristic method as Professor Armstrong magniloquently calls it. The course includes oxygen, hydrogen, nitrogen, and their oxides, and some theoretical considerations. These latter should, we think, come last, and not first; but, after all, the teacher can easily alter the order of the experiments if he will. His chief concern is whether the experiments are suitable and the exposition sound, and on both these points he may safely trust his pupils to Mr. Hill's book.

Macaulay's Lays. Edited by W. J. Addis, B.A. There are many opinions of the merits of Macaulay's poetry, but few people will deny that he owes his fame more to his prose writings than to his verse. But even if we are not inclined to allot to Macaulay a very high place in the list of poets when judged by an absolute standard, we must allow that the Lays are far more suitable for school use than are the works of many greater poets. It is altogether a mistake to imagine that children will acquire a taste for poetry by dosing them with Milton and Shakespeare; to appreciate the higher classes of poetry it is necessary to proceed through the lower. Thus infants should have their nursery rhymes, and school children have narrative poetry. Let them be induced to read for the sake of the subject-matter, and let the poetic feeling work its own way. This edition of Macaulay's Lays, with its able introductions and notes, will do much to cultivate that taste for poetry which is so terribly lacking in the English as a nation.

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Elementary Chemistry. By F. W. Clarke and L. M. Dennis. Before dealing with this book, we must protest against the book notice whereby American houses save reviewers trouble and gain for themselves *kudos*. Instead of being told what the "distinguished authors" have written, we prefer to read the book, and we doubt whether an English reviewer can be found who does not revolt against the book notice, which will tell rather against than for the book it accompanies.

As for the book itself, it is a good average treatise on elementary chemistry, inorganic and organic, and may be read with profit by students studying for the Advanced Stage of the Science and Art Department of the Board of Education, or for the Intermediate Science Examination of London University. We have found nothing strikingly original, but, on the other hand, we have found no blunders; hence we recommend the book as quite up to the average of first courses.

GEORGE BELL AND SONS.

Introduction to Chemistry. By D. S. Macnair, Ph.D., B.Sc. Mr. Macnair's Introduction is so planned as to give a continuous series of experiments whereby the more important laws of elementary chemistry may be discovered in operation by means of appropriate experiments. Some few of the experiments are new, but in the main the course follows the beaten track that past experience has shown to be appropriate and beneficial. The quantitative experiment with chalk on page 74 would, in ninety-nine cases out of a hundred, prove elusive, so certain is it that some of the chalk would be lost. Still Dr. Macnair deserves credit for this attempt to get over the difficulty of using a muffle. We believe the course would be both popular and helpful, as it is on right lines.

The Abbey History Readers, I.–V. This series is a revised edition of the history readers formerly published by Messrs. Bell and Sons, and great care has apparently been exercised in the revision. We think, however, that the revision might have been carried much further: Part I. might have been practically rewritten, and the language simplified. It is always a difficult matter to remember, in compiling a series of this kind, that the primary use of a reading book is to teach reading, and we think the writer would have been more successful had he attempted a text-book of history. Some of the illustrations are good, but others are much behind the artistic productions with which our school children are now supplied.

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Boys and Girls of Other Days. By John Finnemore. The idea of the author of this book is excellent. Instead of reciting the bare facts of history with little or no connection with one another, he weaves them into a romance centred in some boy or girl: thus the tale of the Armada is told by a boy who was taken prisoner by the Spaniards off Falmouth, and escaped when the fleet was dispersed in Calais Roads. The scenes are by this means brought home to the minds of young readers with a vividness which would never be inspired by an ordinary text-book.

Julius Cæsar. By L. W. Lyde, M.A. A very useful school edition. The introduction contains all that is necessary about the source, date, characters, etc.; and the notes are clear, but hardly as full as they might be if the book is to be prepared by private study.

The Story of the Pirate. By W. M. Mackenzie, M.A. Whether there is much value in watering Scott down to the level of school children is a matter on which many diverse opinions might be held. Apart from this, the author has made a very interesting little book out of *The Pirate*, the reading of which may induce boys and girls to study the original.

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The Picture Shakespeare: Macbeth. The illustrations given in this edition serve to interest and assist the minds of young students. The introduction and notes are thoroughly good.

King Lear. Edited by D. Nichol Smith, M.A. This forms another volume of the "Warwick" edition of Shakespeare's plays. The series has already made a reputation for itself by its careful editing, and we can hardly give the present volume higher praise than to say that it is well worthy of its place in the series. The introduction will help the student to appreciate the structure of the drama and the delineation of the characters, while the terse but numerous notes will clear away all difficulties in the text.

A First Latin Course. By E. H. Scott, B.A., and Frank Jones, B.A. The chief point in this book is that it insists on a very large amount of oral teaching. It is an attempt to teach Latin more or less in the way in which modern languages are now taught. We presume that the editors mean the teacher who uses their book always to speak in the so-called modern way. It is most certainly a good thing that boys or girls learning Latin should try to get a certain amount by heart, but we very much fear that it will not be easy to interest many pupils in the subject-matter with which these conversations deal. The essence of the conversational method seems to us to consist in its dealing with things familiar to the eyes and ears of those who use it. As very few specimens of colloquial Latin have come down to us, it is difficult to invent conversations that are at once real and classical. But certainly the book represents an interesting attempt, and we shall be glad, though considerably surprised, to hear of its meeting with marked success.

The Latin Period. By E. A. Wells, M.A. This is clearly a book which will help in revising far more than in originally learning the constructions with which it deals. The author is sometimes too general in his statements. For example, on page 33 we find two "cautions":—

1. "Words such as the following must not be used in *oratio obliqua*: 'here,' 'now,' 'to-day.'"

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3. *British Birds of Prey.*—This picture contains illustrations of eleven of our birds of prey. These are: eagle (white-tailed), osprey, Greenland falcon, peregrine falcon, kestrel, goshawk, sparrow-hawk, kite, buzzard, eagle owl, and tawny owl. For boldness of outline, together with exactness of detail, a better picture could not be imagined. It deserves unqualified and unstinted praise, and should be found in every school.

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The Talisman. (Abridged for Schools.) A very useful school edition, well illustrated and annotated.

Oral Exercises in English Composition. Junior Course of English Composition. By J. C. Nesfield. M.A. Mr. Nesfield has obtained a high and continually increasing reputation as a reliable authority on English grammar and composition, which the two books before us will further enhance. Carefully-graduated exercises, clear and concise rules, and sound advice are to be found on every page.

The Care of Destitute, Neglected, and Delinquent Children. By Homer Folks, Commissioner of Public Charities of the City of New York, etc. This little volume forms one of the series, *American Philanthropy of the Nineteenth Century*, edited by Herbert S. Brown. From the general scheme of the series, the scope of the work is kept strictly within the limits indicated by the title. There is, accordingly, no discussion of educational movements, of the care of children who remain in their own families, of children's hospitals, of the mentally defective, and the like, all of which fall more naturally within the scope of other volumes of the series. As regards the arrangement of this monograph, so much of the narrow space available is occupied by a recital of facts and figures that little room is left for a discussion of principles, tendencies, or results. The work is of undoubted value as a contribution to a history of philanthropy, but its interest to the general reader inevitably suffers from the limitations imposed by the conditions under which it appears. To the specialist in this department the definiteness of aim will of course appear as an advantage.

HORACE MARSHALL AND SON.

The Celtic Wonder-world, and **Tales from the Greek.** These two volumes form numbers one and two of the "Romance Readers." Their subject-matter forms quite a new departure in schoolroom literature, and they should prove useful books in the upper standards of elementary schools, or in secondary schools. Both volumes are capitally illustrated.

RALPH, HOLLAND, AND CO.

Elementary Logic. By Rev. J. Lightfoot, M.A., D.Sc. This is a revised and enlarged edition of *Logic and Education.* The exposition of inductive logic has in this edition been considerably extended, and the work in its present form will prove a useful and reliable text-book to students preparing for university or other examinations where an elementary knowledge of logic forms part of the syllabus.

The Hygiene of Schools and Scholars. By H. Beale Collins, D.P.H. This manual is written for parents and scholars, and contains very much useful advice. The book, however, seems to have been hurriedly prepared, and the composition is occasionally slack. Thus in the preface the author says: "I have endeavoured to arrange the book round the scholar's body to begin with, roughly entering on the anatomy and physiology of the different parts." Needless repetitions are probably due to the same cause. Thus we read on page 40, "The chest contains the lungs, heart, and great vessels;" and on page 41, a special paragraph tells us that "the lungs, with the heart and big blood-vessels, occupy the cavity of the chest."

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The Block Grant: Illustrated Object Lessons for Infants and the Lower Classes of Schools for Older Scholars. By Margaret Cameron, L.L.A. This book contains twenty beautifully-executed plates in black and white, with a page of valuable notes on each. The set comprises such subjects as, "Ant, Bee, and Beetle," "Silkworm," "Spider," "Snail," "Mole and Bat," "Serpent," "Tortoise," "Frog," "Feet of Animals," "Trees," "Fruits," "Useful Plants," "Modes of Fishing," "Homes of Animals," etc. For the purposes of illustration to large classes we have seen nothing superior to these plates. Every drawing can be easily copied on the blackboard, and all extraneous and unnecessary details are omitted. The notes are just such as a teacher needs, being accurate, suggestive, and interesting. The price, 3s. 6d., seems a long one for a work of this kind, but the amount of assistance in the way of illustration is unusual.

The Block Grant Schemes: Elementary Science and Common Things. Forty Lessons for Standard I. By J. Pendlebury. Book I. The writer of this book has discarded the old method of arranging notes under "heads," "matter," and "method," and instead has chosen a form often used by chemists—namely, "experiment," "observation," and "inference." While there is much to be said in favour of this method, it does not seem to us to find room for pictorial or verbal illustrations, which did manage to creep into the notes under the old system.

The matter of the book is printed in three colours—the experiment is in black, the observation in blue, and the inference in red. While this must have added materially to the cost of the book, we cannot see much is gained by it; for the book is designed for teachers, who, in looking over the notes, will be guided just as well by the printed headings, "experiment," "observation," and "inference," as by the colours. We observe that the qualities of objects are introduced which have no economic or other value. For example, on p. 47 the children are led to the conclusion that chalk is not transparent. Having reached this conclusion, it has no value, and one would have just as much warrant, when giving a lesson on the elephant, in concluding that it was opaque, though of what use that would be is another matter. The two next items in the same lesson, on the softness and brittleness of chalk, would have an increased value if the children were led to see that on account of those qualities chalk cannot be used for building.

There seems to be no system in the blackboard notes, except that red and blue are used alternately. Blue is a difficult colour to discern at a distance—though perhaps the author does not intend to indicate what colours shall be used, so long as coloured chalks are employed. Some of the blackboard notes run to thirteen and fourteen heads; this is too much for the children in Standard I. to carry away at one time.

The lessons comprise a great variety of subjects; but in the arrangement of a future edition, Lesson 28, on "the action of heat and cold on a thermometer," should follow Lesson 29, on "the action of heat and cold on liquids."

The Code for 1902-3. *School Board Chronicle* edition. Mr. Cornish has compiled, as usual, a most valuable volume. This edition of the Code is too well known to require any praise from us. All interested in elementary education, and especially all managers of primary schools, will find this book a veritable encyclopædia. It contains over 500 pages, and is marvellously cheap.

The New Code (1902-3). N.U.T. edition. The editors are to be congratulated upon the concise and clear way in which they have done their work. This is essentially a teacher's edition. At the same time, all educationists will find it useful. The index, a very important section of a work like this, is an excellent one.

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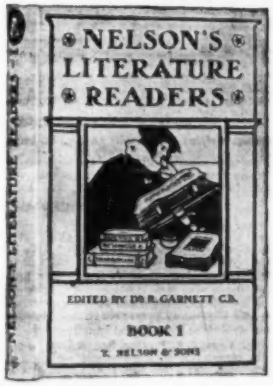

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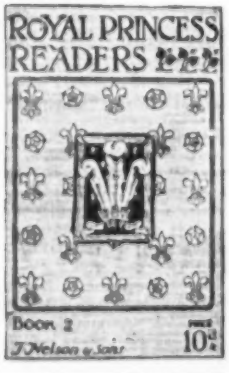

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CONTENTS.

Introduction, ...	9
Class Organization, ...	13
Preliminary Practice, ...	17
Outlines of Ornament, ...	24
Object Drawing, ...	35
Outline, ...	51
Blackboard Technique, ...	56
Natural Forms: Plants and Shells, ...	68
Natural Forms: Animals, ...	81
The Brush, ...	93
Charcoal, ...	101
Memory Drawing, ...	107
Blackboard Drawing in the Classroom, ...	115
The Illustration of Narrative, ...	124
Light and Shade, ...	128
In the Examination Room, ...	131
Appendix, ...	133

Prefatory Note by Walter Crane.

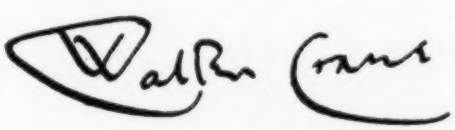
MR. ALLEN W. SEABY has written a very practical and useful work upon a very important subject, which I desire to commend to the attention of all interested or engaged in teaching.

The value of the power of rapid demonstration to a class teacher or lecturer (as well as to his audience), in the elucidation or illustration of his subject, cannot be over-estimated; and the acquisition of facility in a large and typical kind of drawing with the chalk on the blackboard, or with charcoal or the brush on white paper, on a large scale, becomes of the first consequence to all engaged in educational work.

Mr. Seaby, as teacher of design and drawing in the Art Department of Reading College, possesses the advantage of an extensive experience in class teaching, and brings to his subject not only definite and sound ideas, and systematic methods of work, but also considerable artistic skill and power of draughtsmanship, of which the numerous and excellent illustrations in this book bear witness.

It is evident that the aid of drawing is absolutely necessary to vitalize all kinds of knowledge, and that it is impossible without it to convey clear and definite ideas to the mind. Whether we regard it as an expounder of the forms, the structure, the beauty of nature, and the analyzer of natural fact; whether we value it as the demonstrator of scientific discovery or historic study; or whether we are charmed by its own inherent power of expression in the language of art and beauty and the harmony of design, we must always need its help.

KENSINGTON, *July 10, 1902.*



Extracts from Introduction.

THIS book has but one aim—that of helping students to express clearly and readily their mental images of objects, to assist in developing a power of expression which is allowed to lie dormant in most of us. We see on the stage emotion expressed by facial movement, and by gesture and attitude. We ourselves constantly convey our meaning by this means, in addition to speech. And the power of *graphic* expression, of putting down in a few simple strokes a presentment of the object to be described, would be useful to most people. One often hears the remark, "I wish I could draw it for you." The agriculturist needs this power in order to make notes of insect pests, etc., so that he may warn his fellows; the mechanic is frequently at a loss if unable to make a rough sketch of some part of a machine which has been broken and needs repair. But those who most frequently resort to graphic expression are teachers—of all grades, from the infant teacher to the lecturer on scientific subjects—and by common consent they all make their rough sketches on the blackboard. Hence the title of this book. It may be said at once that blackboard drawing has a technique of its own. Good draughtsmen, when confronted with a blackboard, sometimes make weak and ineffective drawings on it, with thin, meagre lines; this is because their work has not led them to study the limitations and conventions of blackboard sketching. The use of the chalk, and its importance to teachers, need not be enlarged on here.

Great attention has of late been drawn to blackboard sketching through the publication of Mr. Liberty Tadd's book setting forth his system of teaching at Philadelphia, and, more recently, through his lectures in England.

Other events have contributed to give blackboard drawing its present prominent position. Last year, the Board of Education issued their new scheme for students in training, and the suggested course in drawing was mainly blackboard sketching—the fitting of the teacher for demonstrating with the chalk. The Board have also recently issued an important circular on drawing in primary schools, accompanied by a series of illustrations designed by Mr. Walter Crane. This circular strongly recommends some form of freearm drawing for children.

For the most part, as may be seen, the illustrations in this book are photographic reproductions of blackboard drawings, many having been made in actual class teaching of students. Several books on blackboard drawing have been published, in which the drawings have been made with white paint on a black ground, on a small scale. When these are put forward as blackboard sketches, great harm is done; because the effect is quite unattainable with the chalk, and the student is apt to be disappointed and discouraged.

The drawings in this book, therefore, must not be looked on as examples to be copied, but as *suggestions*. They are marked by the faults common to blackboard sketching—hurried drawing, and exaggeration caused by insistence on the point to be brought out. The blackboard sketches were drawn on a board three feet square, and the charcoal drawings on sheets of paper sixteen inches by twenty.

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Fig. 91.

The graphic faculty is doubly exercised, resulting in a greater keenness of vision and control of hand to express form.

How, then, can this expressive line be translated into a blackboard sketch? In the white chalk drawings shown in these pages, though in a sense the form is abstract,

Fig. 92.

because light and shade are eliminated, yet a feeling for solidity, of roundness or relief, is still to be perceived. The line is broken to allow some forms to jut out in front of others. Notice in the sketch of the cow grazing (see Fig. 137) the overlapping contours,

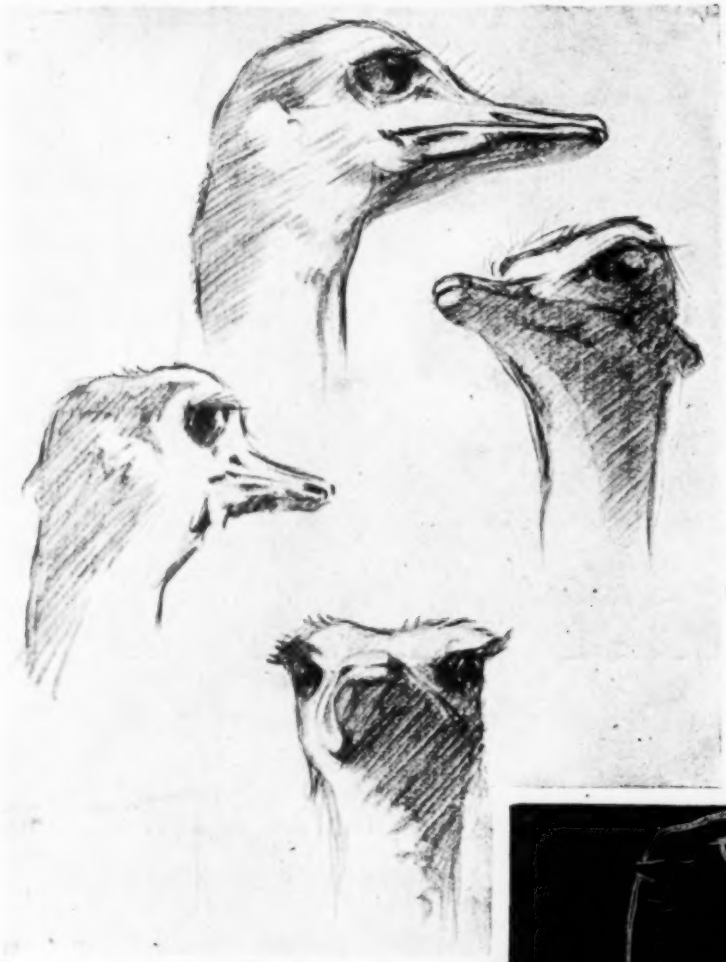

Fig. 181.

the ability to draw from recollection objects which the student has not actually studied pencil in hand. This depends upon the cultivation of what I may call the visual memory. I have referred to the Japanese system of training in drawing, which was a training mainly in looking, the development of a keen observation. Students have been tested on these lines in the examinations held by the Board of Handwork, an object or group being placed before the student, who, after examining it, reproduces the view from memory.

the student wishes to memorize the two types, the fact, once noticed, that the body of the moth projects above and below the simple shape, while the body of the butterfly comes well within, cannot be forgotten.

At the Board of Education's examination, a list of objects which the student is prepared to draw from memory is asked for by the examiner, who expects the student to supplement the sketch with other views, to show that the actual object has been drawn from.

The goal to be aimed at in memory drawing is

Fig. 182.

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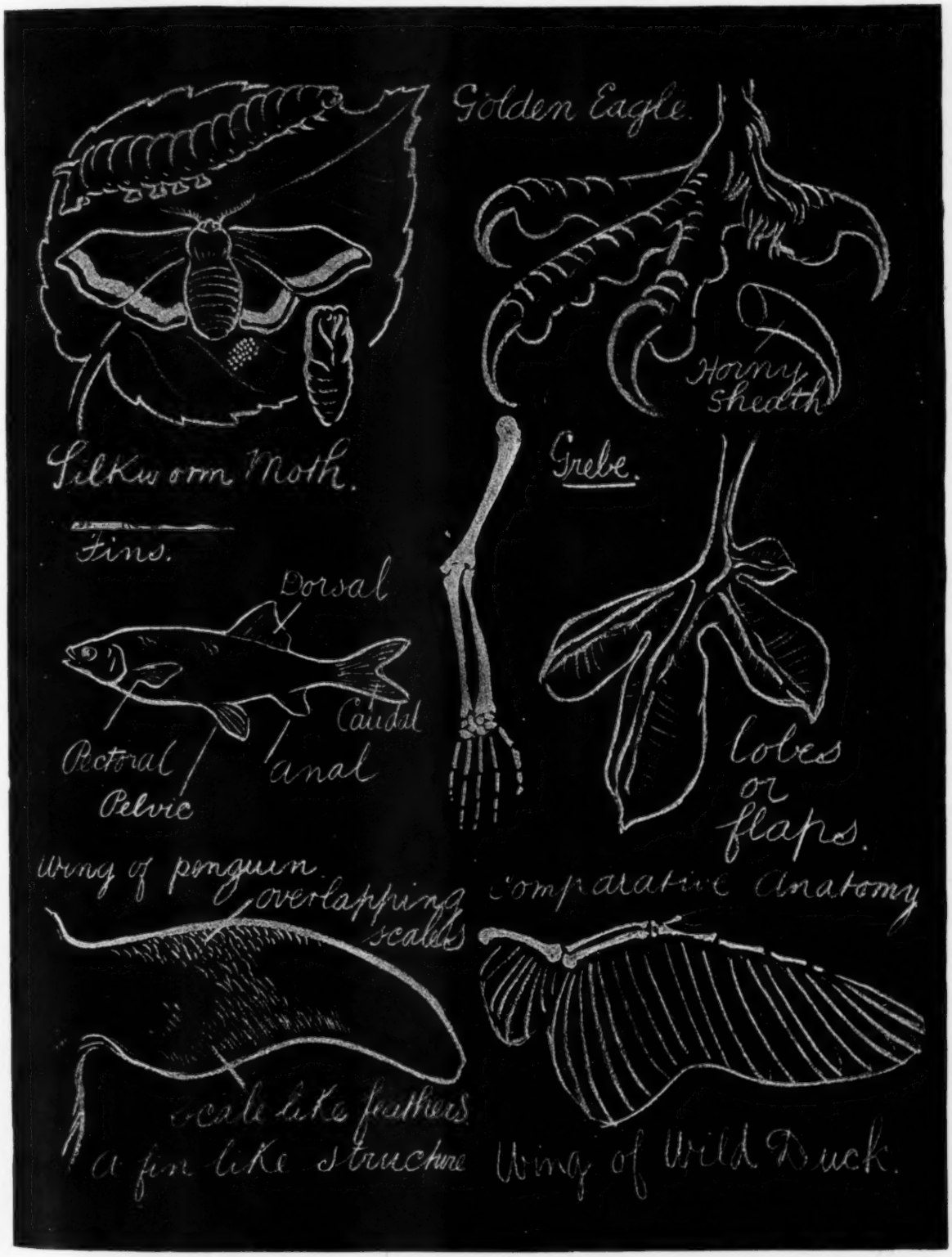

Fig. 206.

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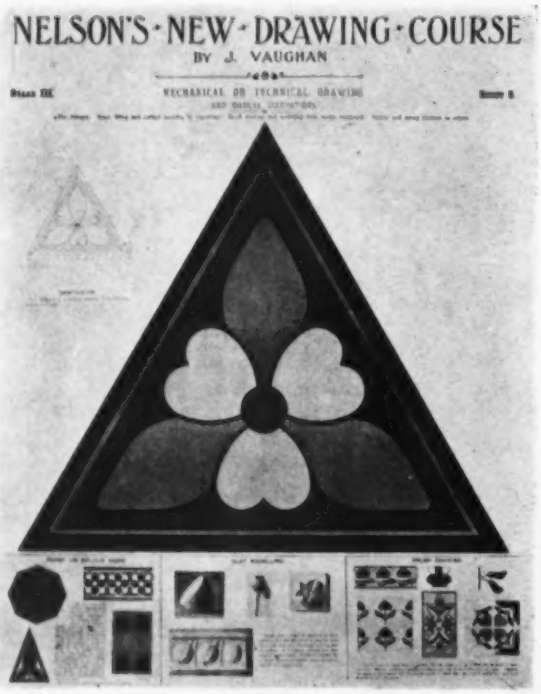

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